Merrimack Village Dam
Final Report: Phase I-
Dam Removal Feasibility Study
VOLUME 2: Figures & Appendices

Prepared by:

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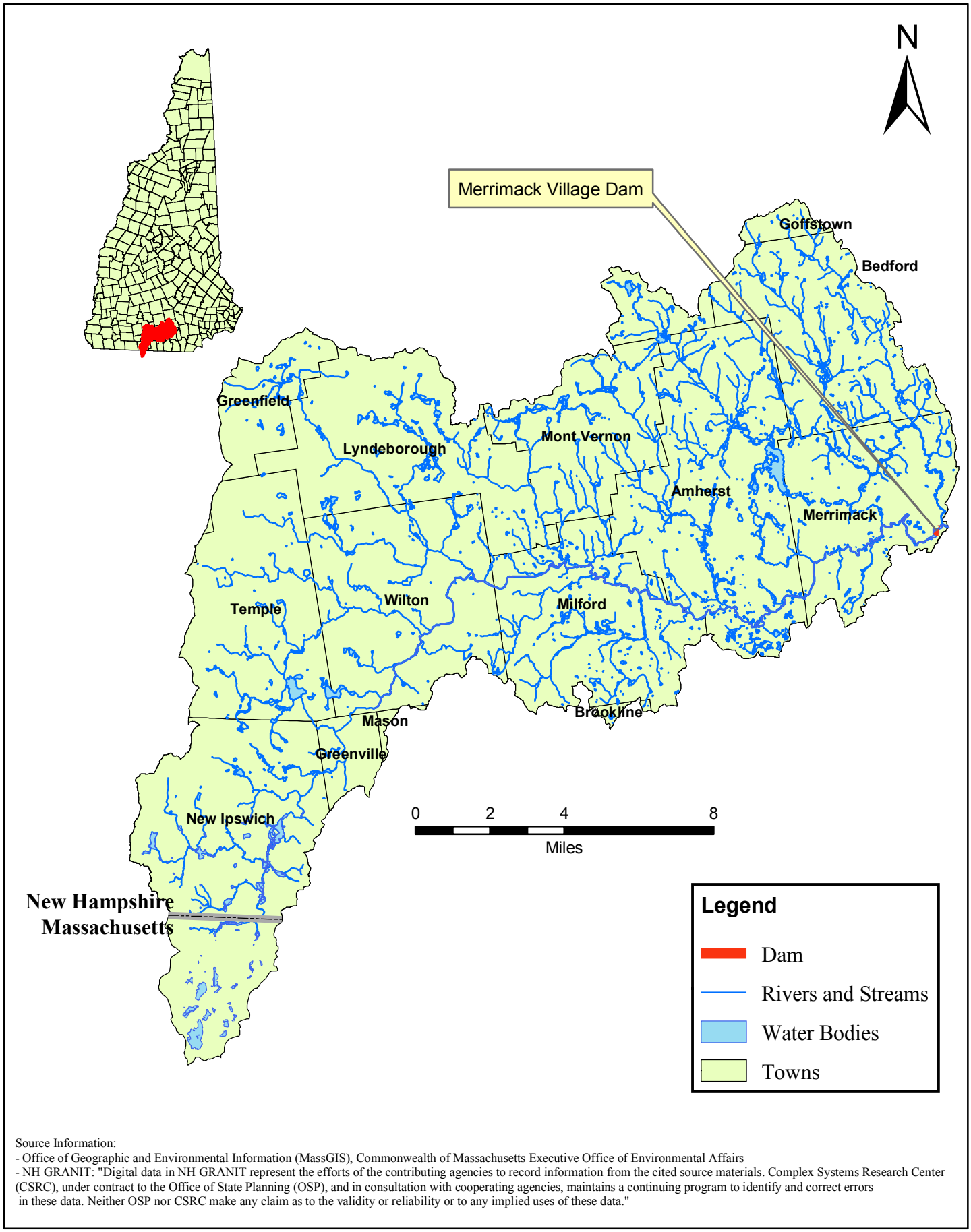
December 2004

Figure 1.1-1: Location Map of Merrimack Village Dam

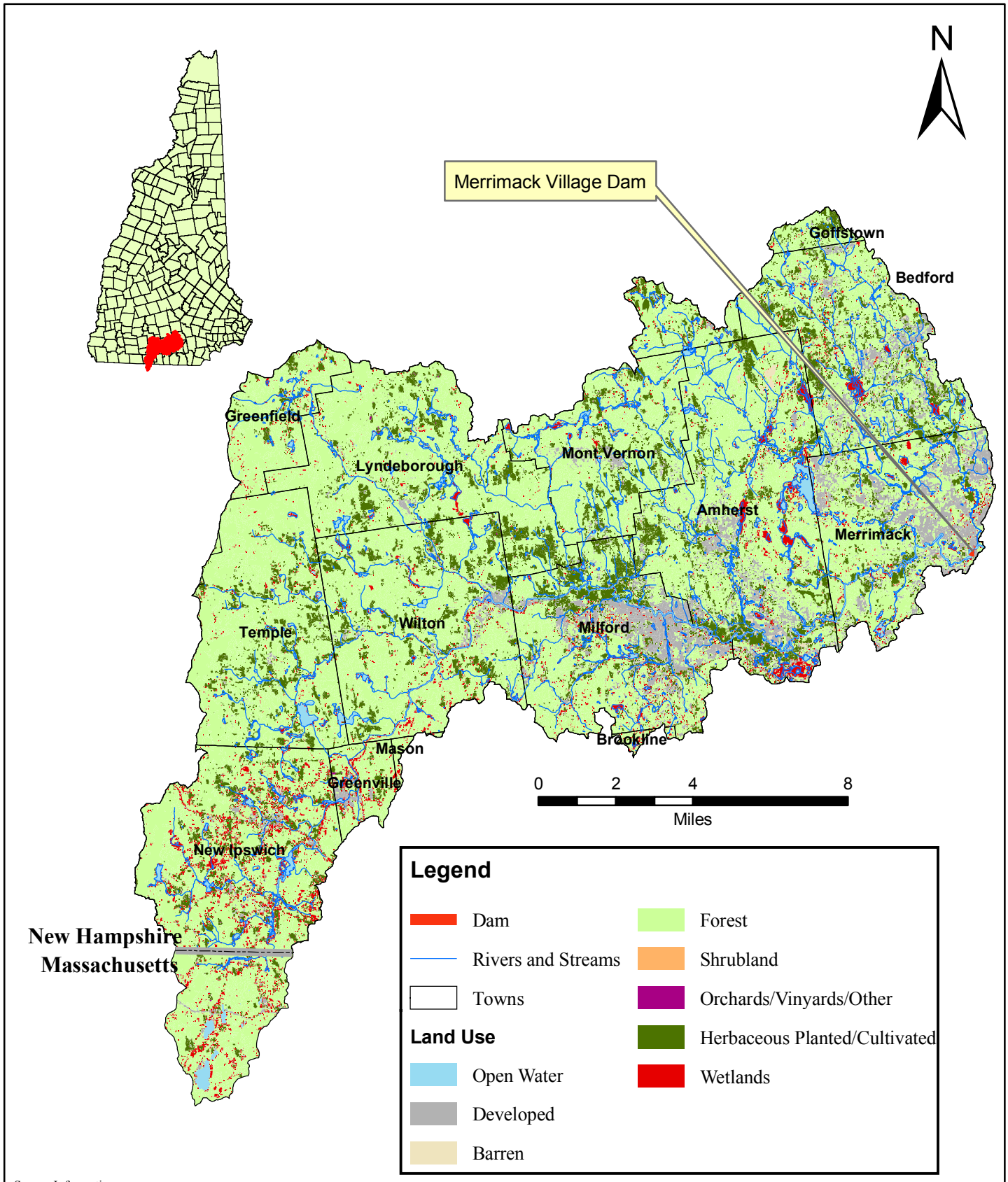
Source Information:
- NH GRANIT: "Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."

Figure 3.1-1 Souhegan River Watershed - Base Map



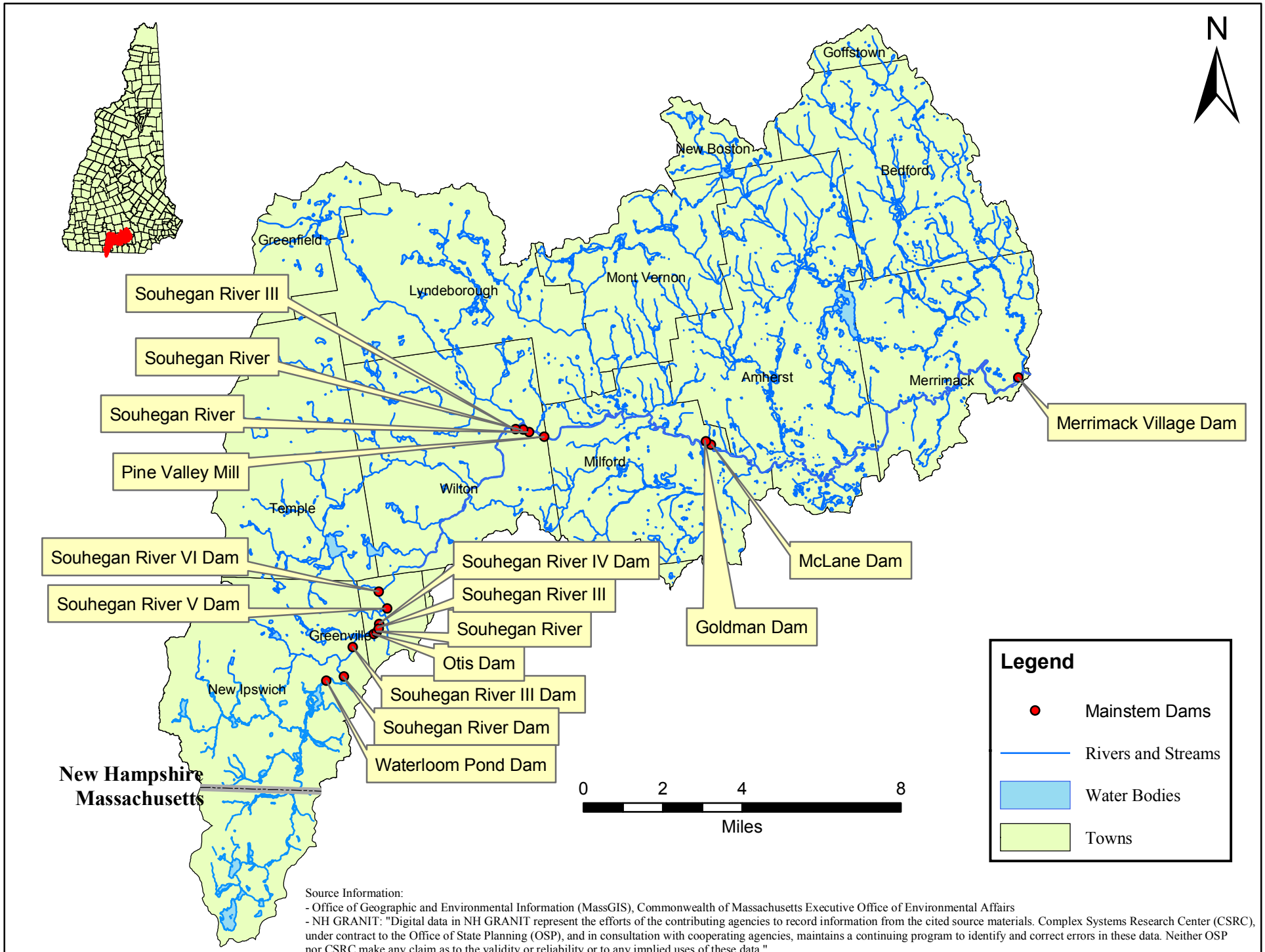
Source Information:
- Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
- NH GRANIT: "Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."

Figure 3.1-2: Souhegan River Watershed - Land Use



Source Information:
- Land Use: USGS - NLCD Regional Land Cover Classification System Key Rev. 07/99
- Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
- NH GRANIT: "Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."

Figure 3.1-3: Souhegan River Watershed - Mainstem Dams



Source Information:
- Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
- NH GRANIT: "Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."

Mean and Median Monthly Flows at Souhegan River at Merrimack (USGS Gage No. 01094000), Period of Record: 1909-1976, 2001-2003, Drainage Area= 171 sq mi

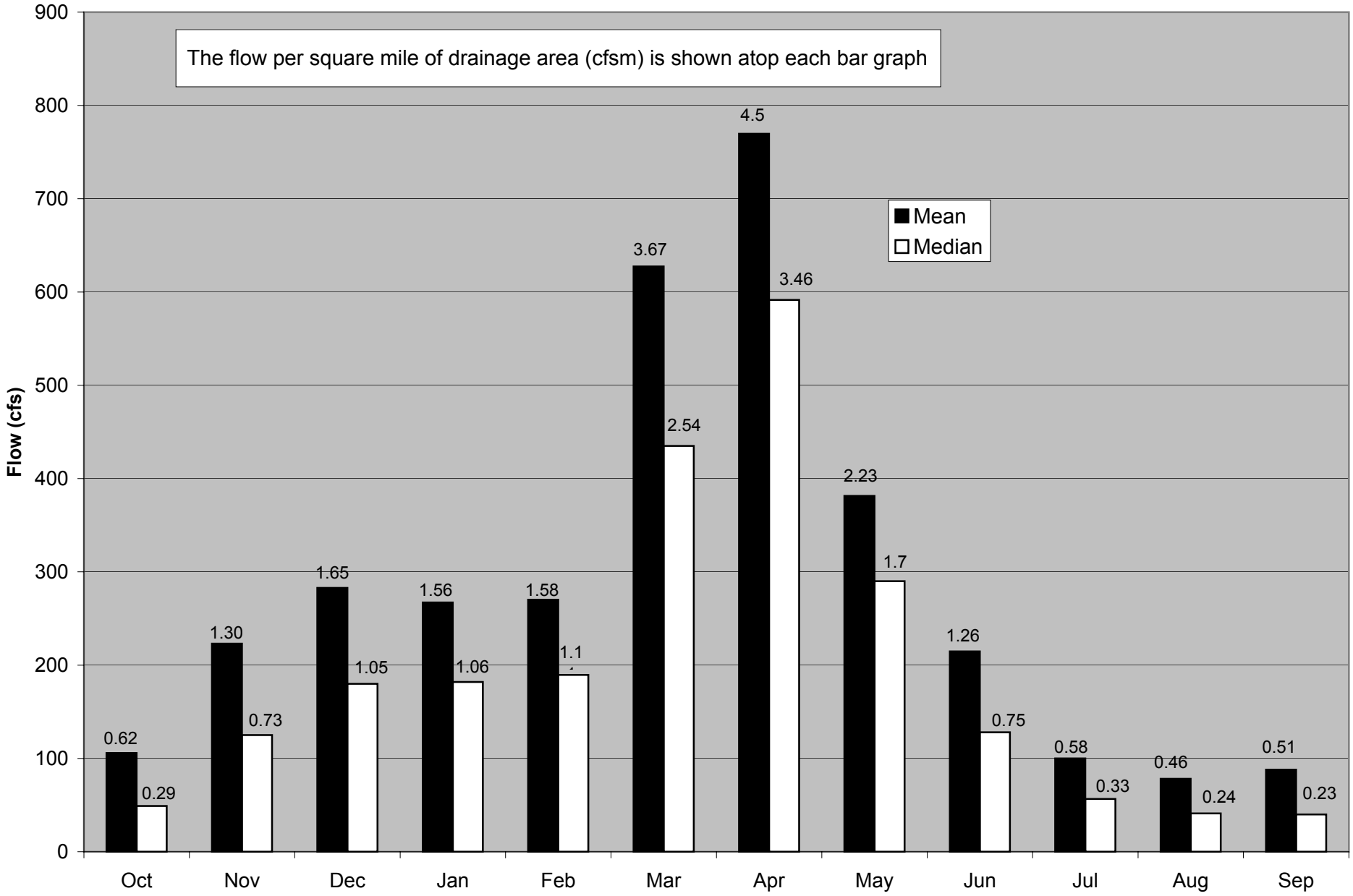


FIGURE 3.2.1-1

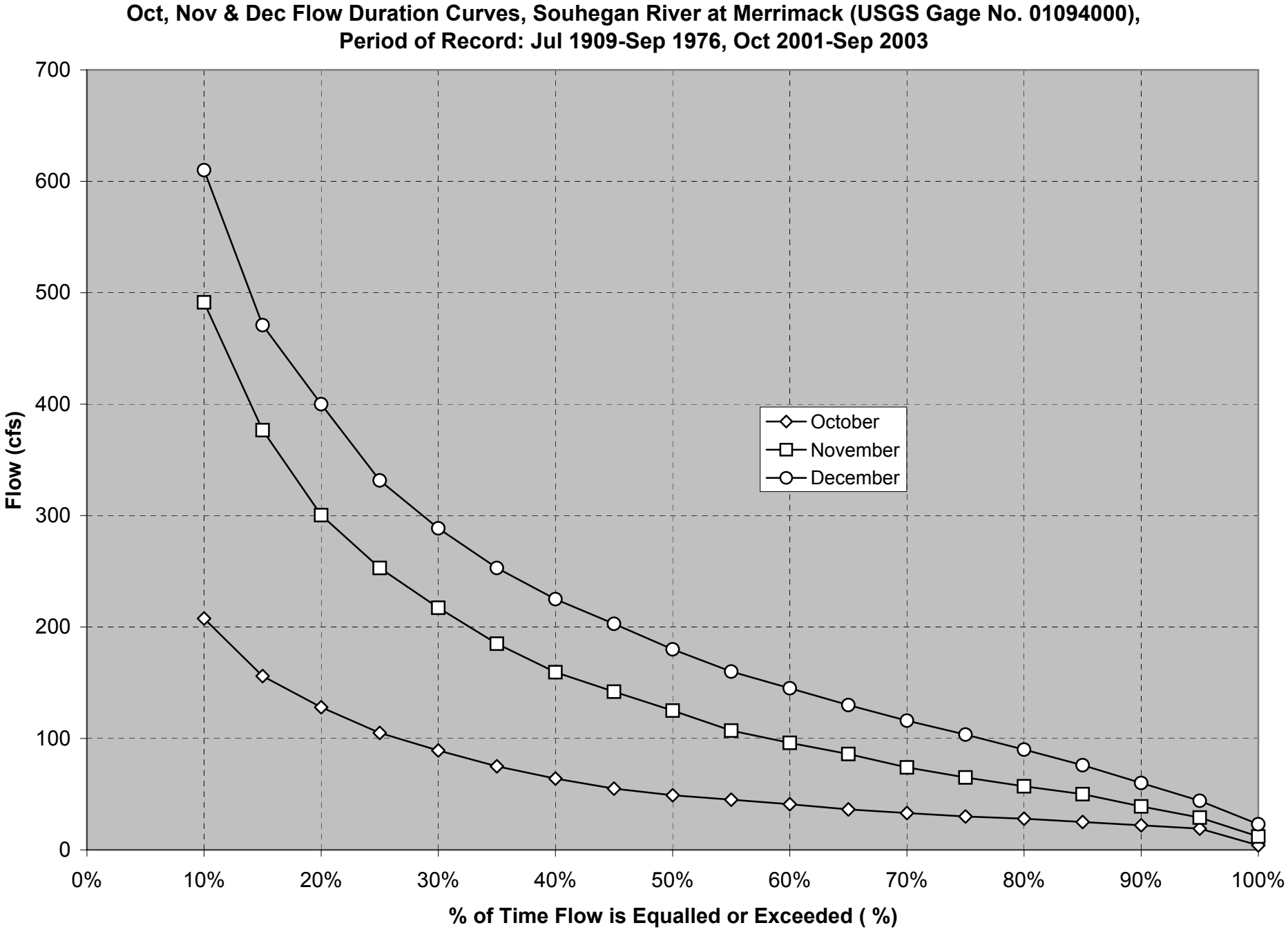

Oct, Nov & Dec Flow Duration Curves, Souhegan River at Merrimack (USGS Gage No. 01094000),
Period of Record: Jul 1909-Sep 1976, Oct 2001-Sep 2003
700
600
500
400
300
200
100
0
Flow (cfs)
October
November
December
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
% of Time Flow is Equalled or Exceeded (%)

FIGURE 3.2.1-2

Jan, Feb & Mar Flow Duration Curves, Souhegan River at Merrimack (USGS Gage No. 01094000), Period of Record: Jul 1909-Sep 1976, Oct 2001-Sep 2003

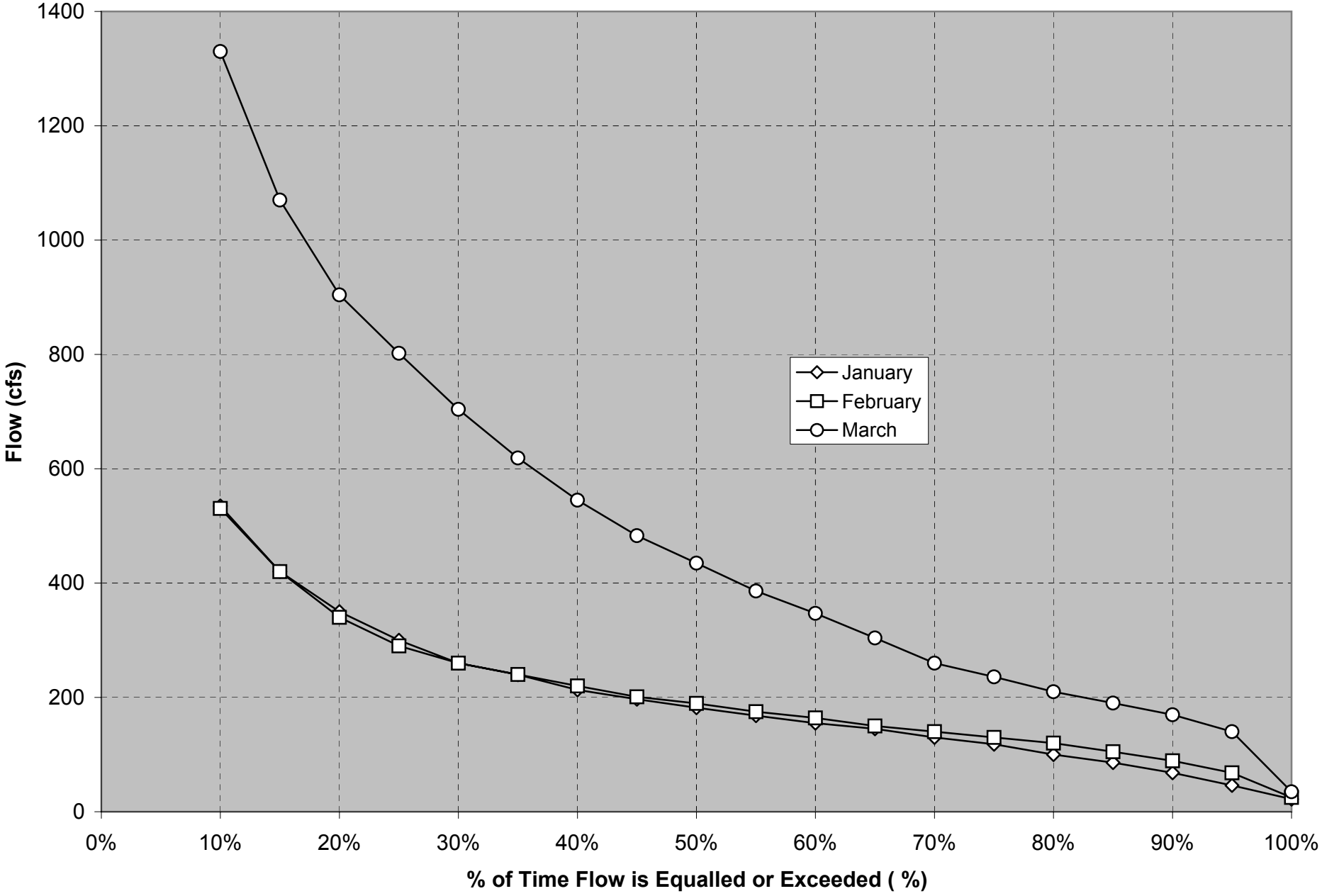


FIGURE 3.2.1-3

Apr, May & Jun Flow Duration Curves, Souhegan River at Merrimack (USGS Gage No. 01094000), Period of Record: Jul 1909-Sep 1976, Oct 2001-Sep 2003

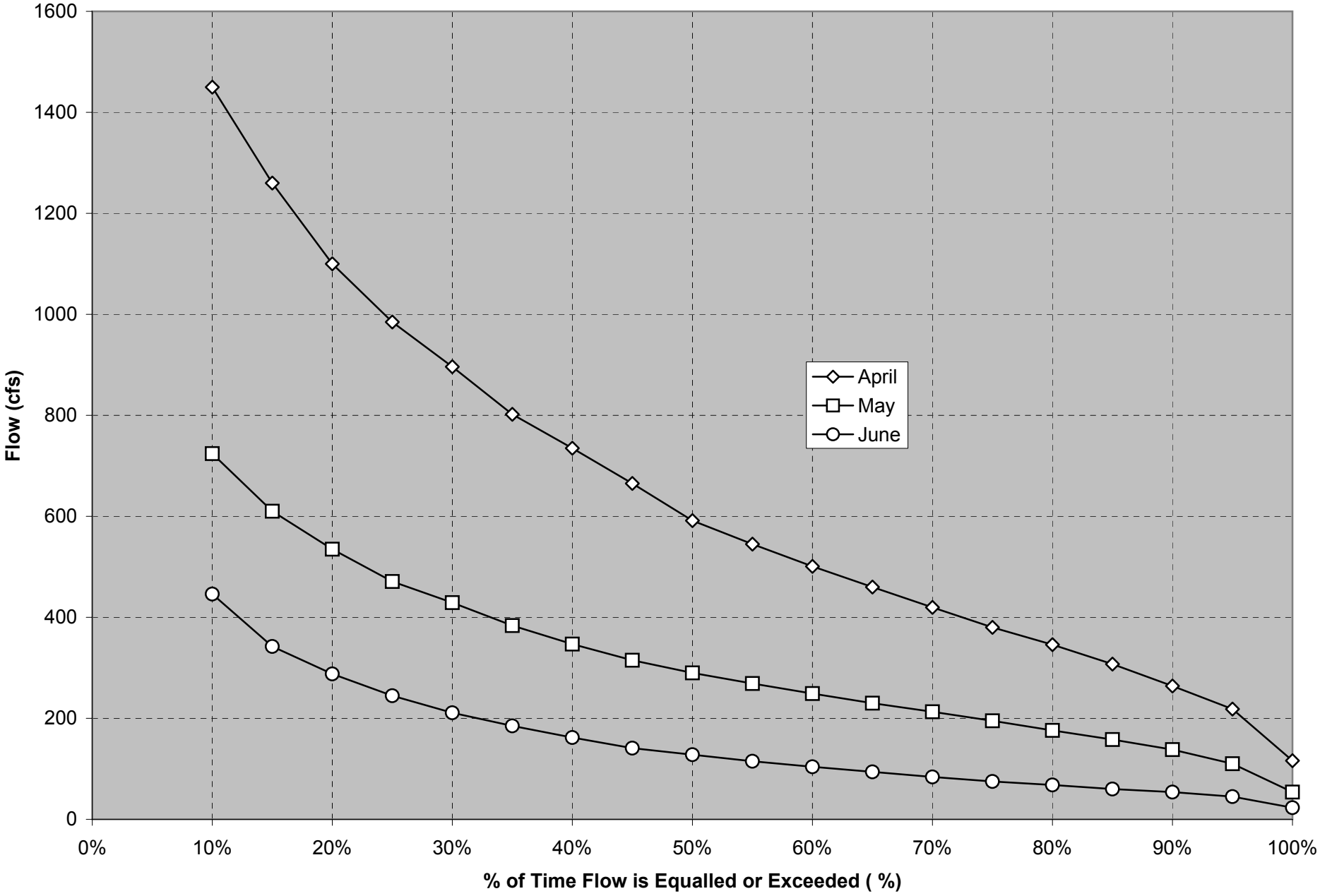


FIGURE 3.2.1-4

Jul, Aug & Sep Flow Duration Curves, Souhegan River at Merrimack (USGS Gage No. 01094000), Period of Record: Jul 1909-Sep 1976, Oct 2001-Sep 2003

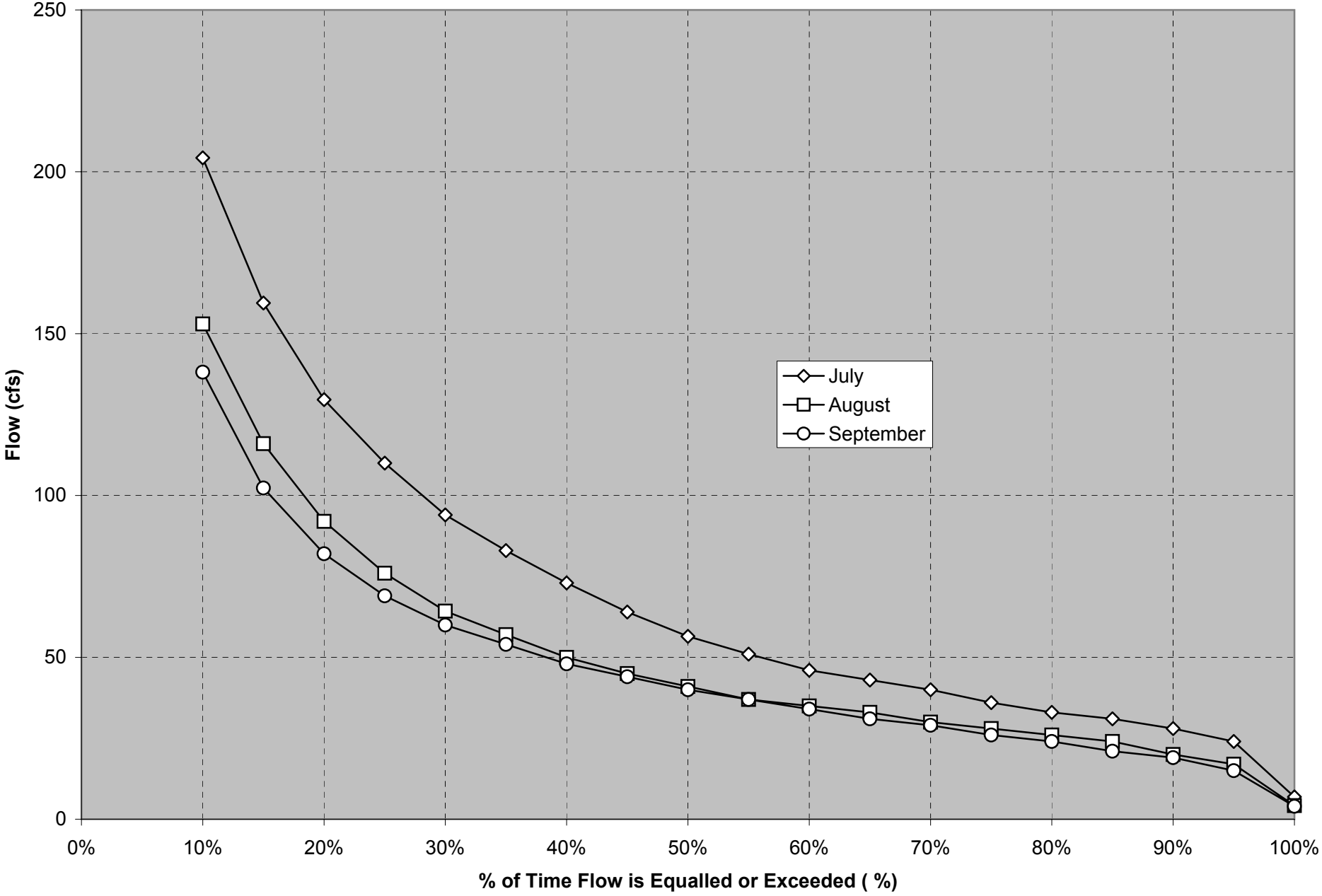


FIGURE 3.2.1-5

Annual Flow Duration Curve, Souhegan River at Merrimack (USGS Gage No. 01094000), Period of Record: Jul 1909-Sep 1976, Oct 2001-Sep 2003

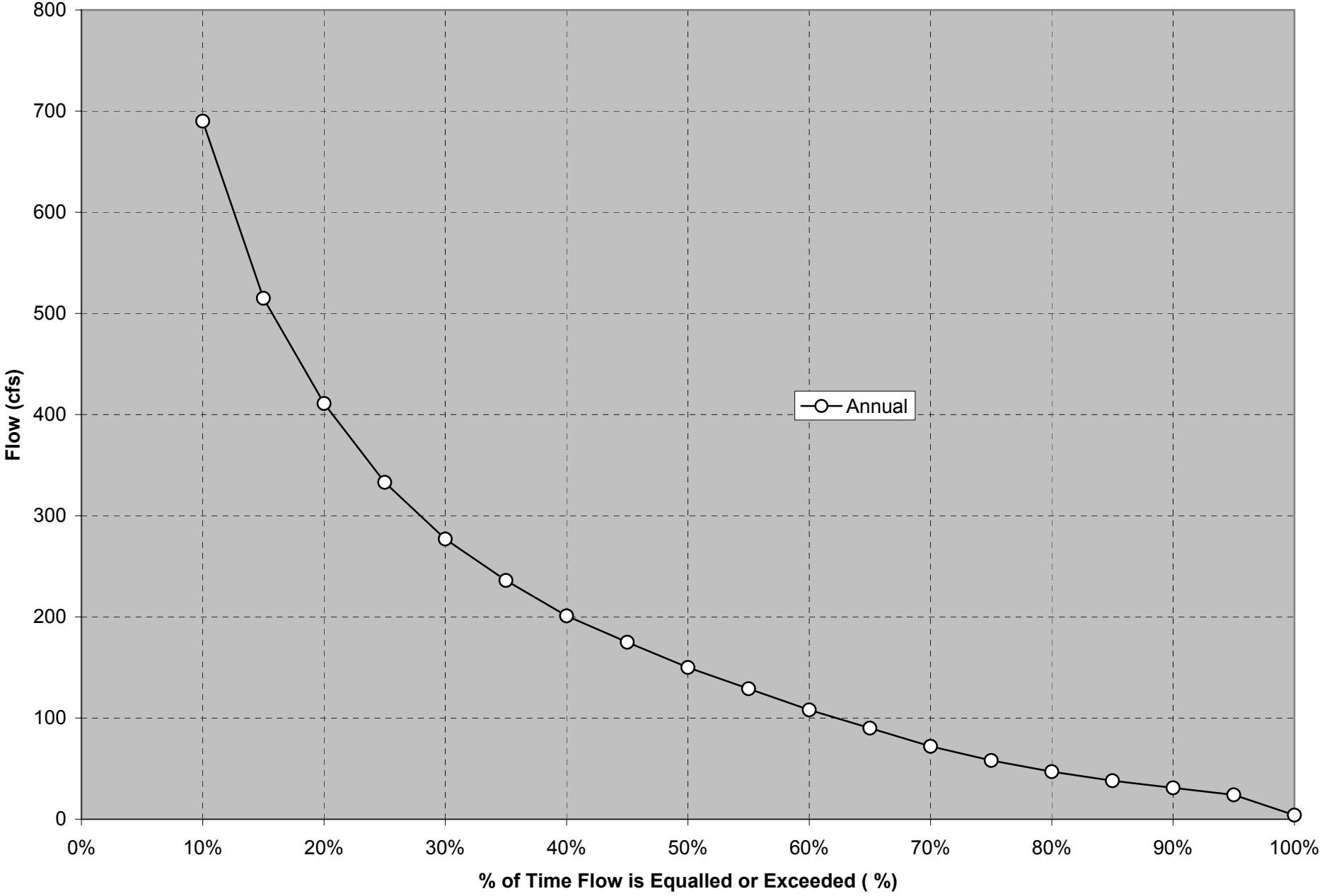
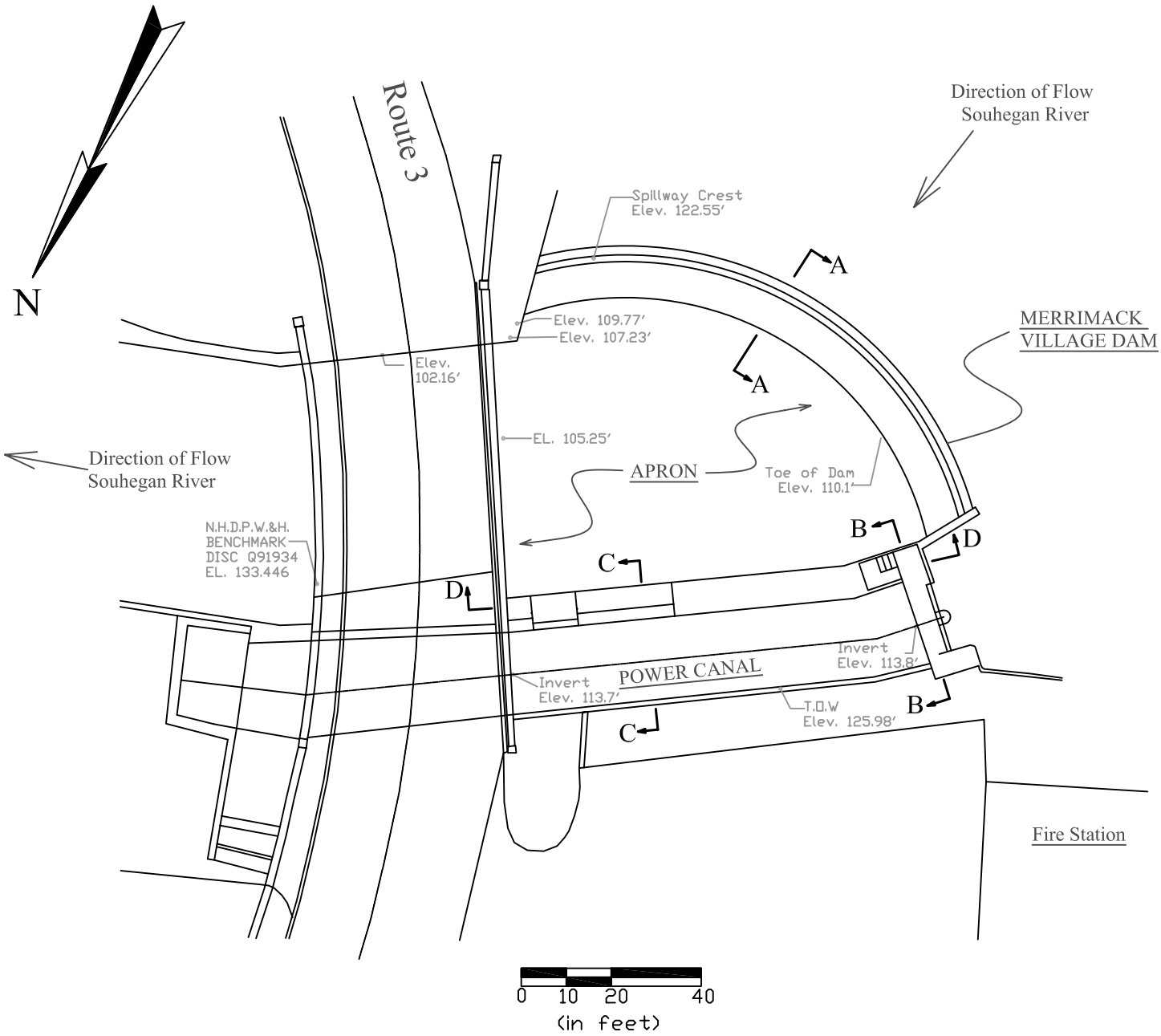


FIGURE 3.2.1-6



NOTES

1. Figure developed from drawings made by Halliwell Associates in 1984 for a FERC licensing application for the Merrimack Village Dam. FERC Drawing No. 8714-1.

2. Drawing has been altered to reflect current conditions at the MVD site.

FIGURE 4.1-1

Merrimack Village Dam Plan View

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: TOM DAIGLE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: June 2004	
	Scale: 1" = 35'

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
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Utica, NY 13501
(315) 724-4860
55 North Stark Highway
Weare, NH 03281
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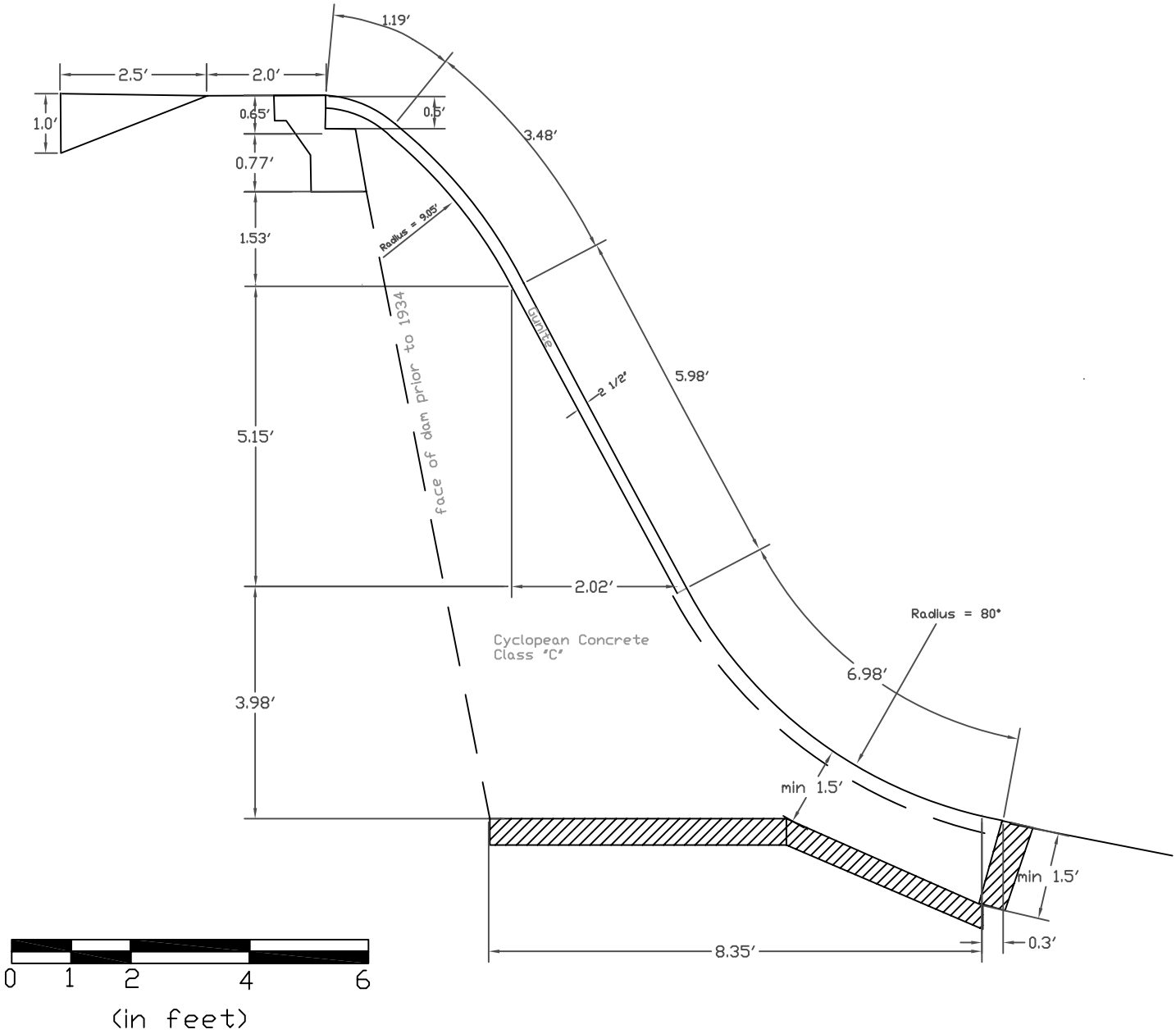

Section A-A

NOTES

1. Figure developed from the NH State Highway Department drawings of changes made to the Merrimack Village Dam in 1934.

2. See Figure 4.1-1 to locate cross-section A-A in Plan View.

FIGURE 4.1-2

Merrimack Village Dam
Cross-Section A-A

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: August 2004	

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Engineers and Environmental Scientists
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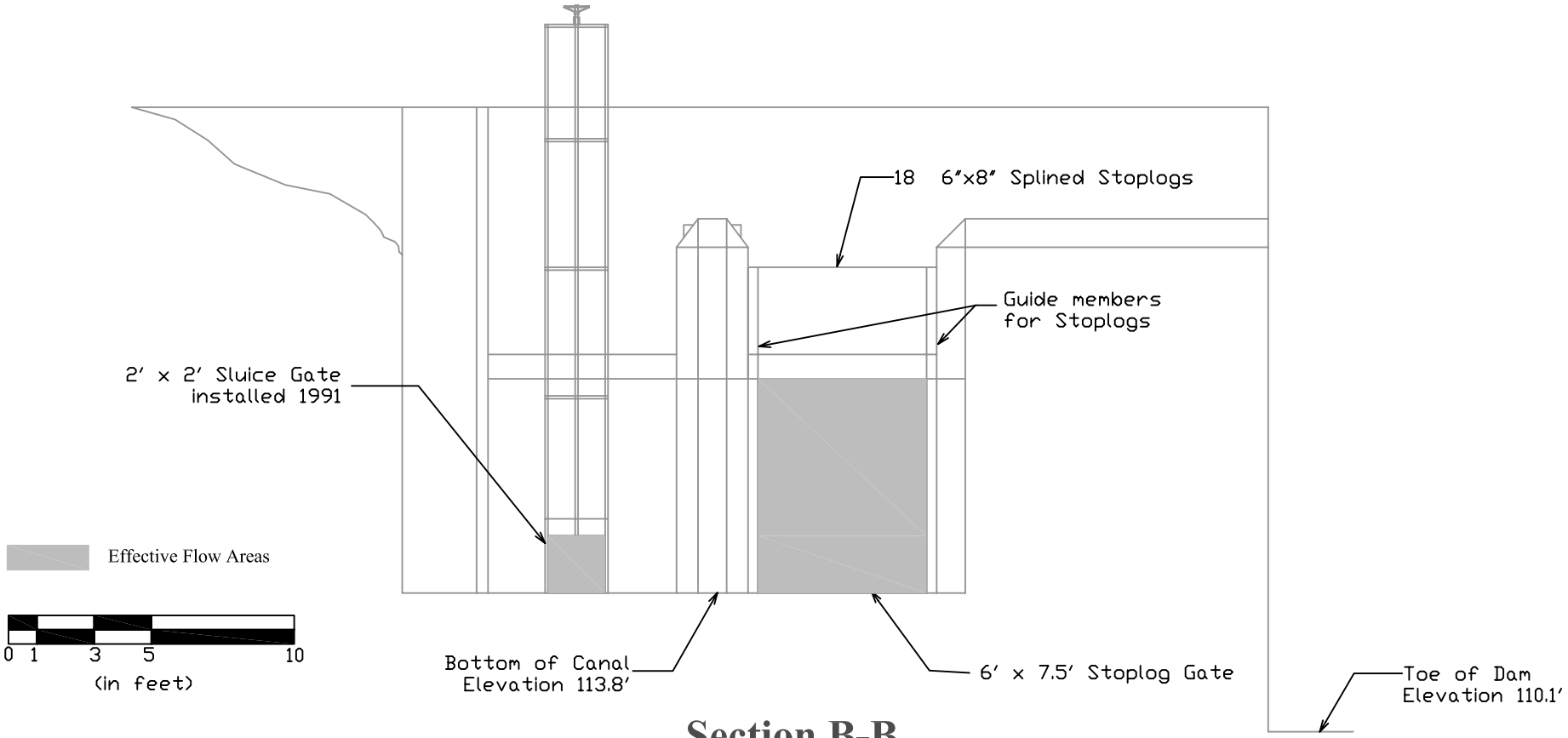
55 N. Stark Highway Weare, NH 03281 (603)529-4400

Scale: 1" = 2.75'



Section B-B

NOTES

1. Drawings based upon a partial survey of the canal and dam structures taken during a site visit on June 29, 2004 by Gomez and Sullivan Engineers, P.C.

2. Vertical datum is NGVD 1929. Reference NH DPW&H benchmark disk Q91934 Elevation 133.446 feet. Located on the northeast parapet wall of the Route 3 bridge over the Souhegan River.

3. See Figure 4.1-1 to locate cross-section B-B in Plan View.

Photo taken May 18, 2004 by GSE.

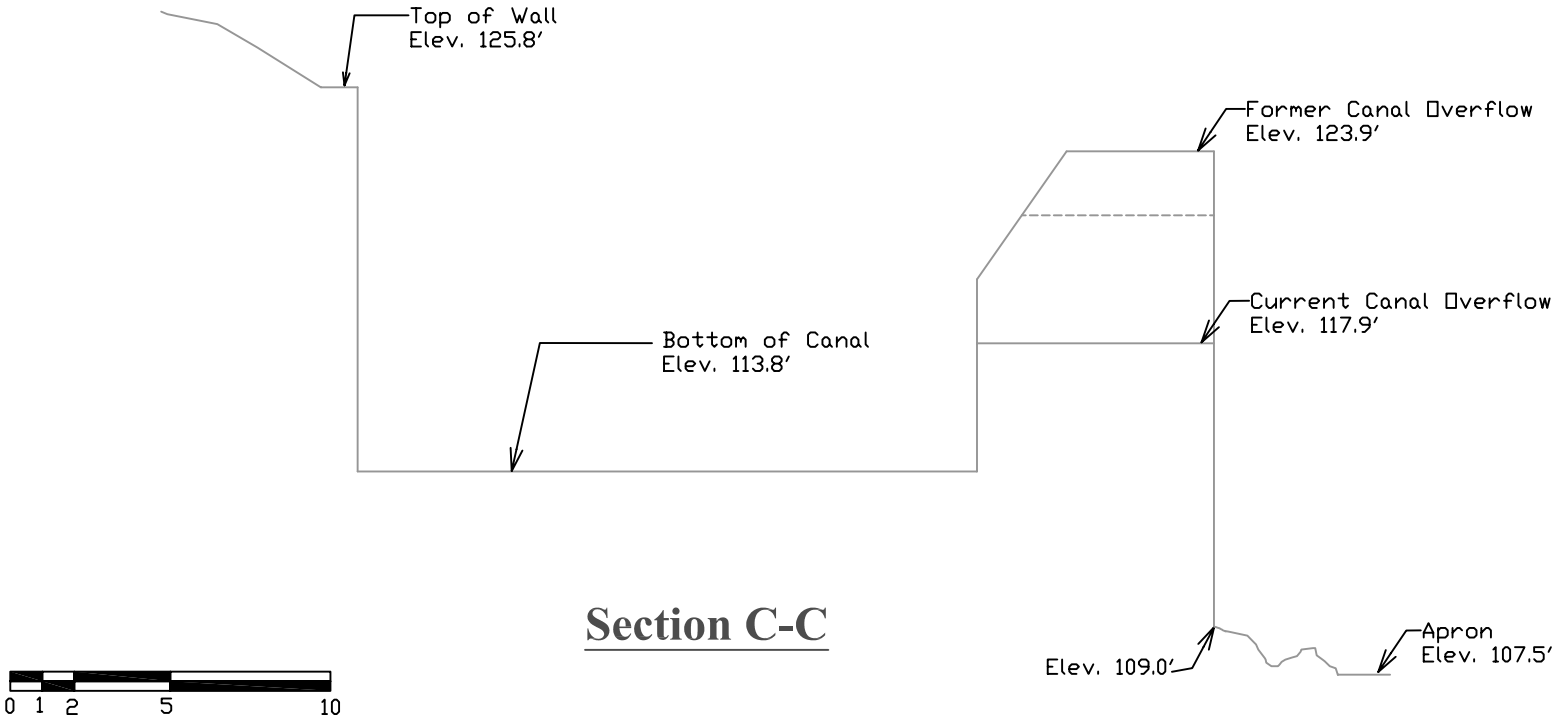
FIGURE 4.1-3

Merrimack Village Dam Gate Cross-Section B-B (Downstream View)

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: July 2004	
Scale: 1" = 6'	

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
288 Genesee Street, Utica, NY 13501, (315) 724-4860
55 North Stark Highway, Weare, NH 03281, (603) 529-4400



Section C-C

NOTES

1. Drawings based upon a partial survey of the canal and dam structures taken during a site visit on June 29, 2004 by Gomez and Sullivan Engineers, P.C.

2. Vertical datum is NGVD 1929. Reference NH DPW&H benchmark disk Q91934, Elevation 133.446 feet. Located on the northeast parapet wall of the Route 3 bridge over the Souhegan River.

3. See Figure 4.1-1 to locate cross-section C-C in Plan View.

Photo taken October 20, 2003 by GSE.

FIGURE 4.1-4

Merrimack Village Dam Canal Cross-Section C-C (Downstream View)

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: July 2004	

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
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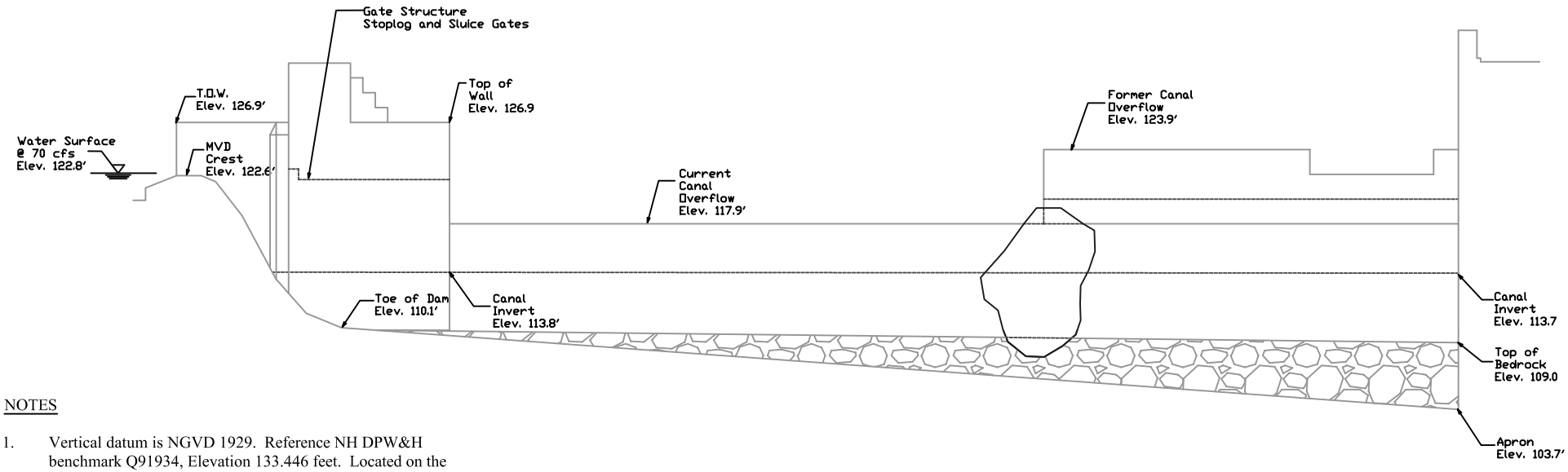
Scale: 1" = 4'



NOTES

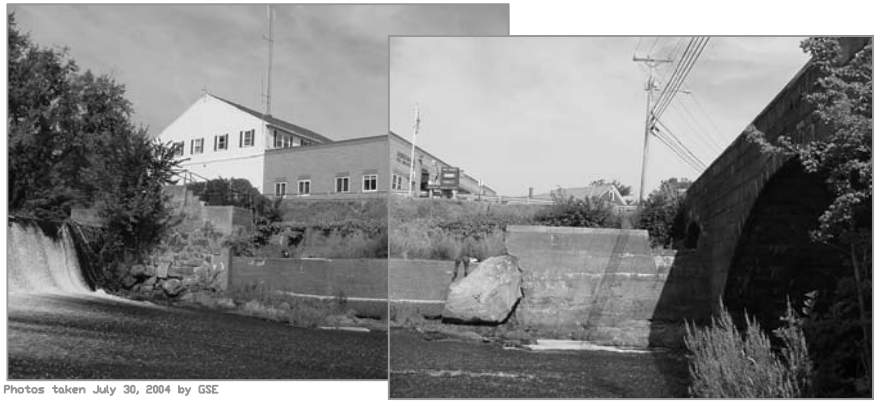
1. Vertical datum is NGVD 1929. Reference NH DPW&H benchmark Q91934, Elevation 133.446 feet. Located on the northeast parapet wall of the Route 3 bridge over the Souhegan River.

2. Elevations taken as a partial survey during a site visit on June 29, 2004 by Gomez and Sullivan Engineers, P.C.

3. Canal Invert and Gate, Dam, and Apron are projected into view.

4. See Figure 4.1-1 to locate cross-section D-D in Plan View.

Section D-D



Photos taken July 30, 2004 by GSE

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: July 2004	

FIGURE 4.1-5

Merrimack Village Dam Canal Profile D-D

Merrimack Village Dam - Dam Removal Feasibility Study

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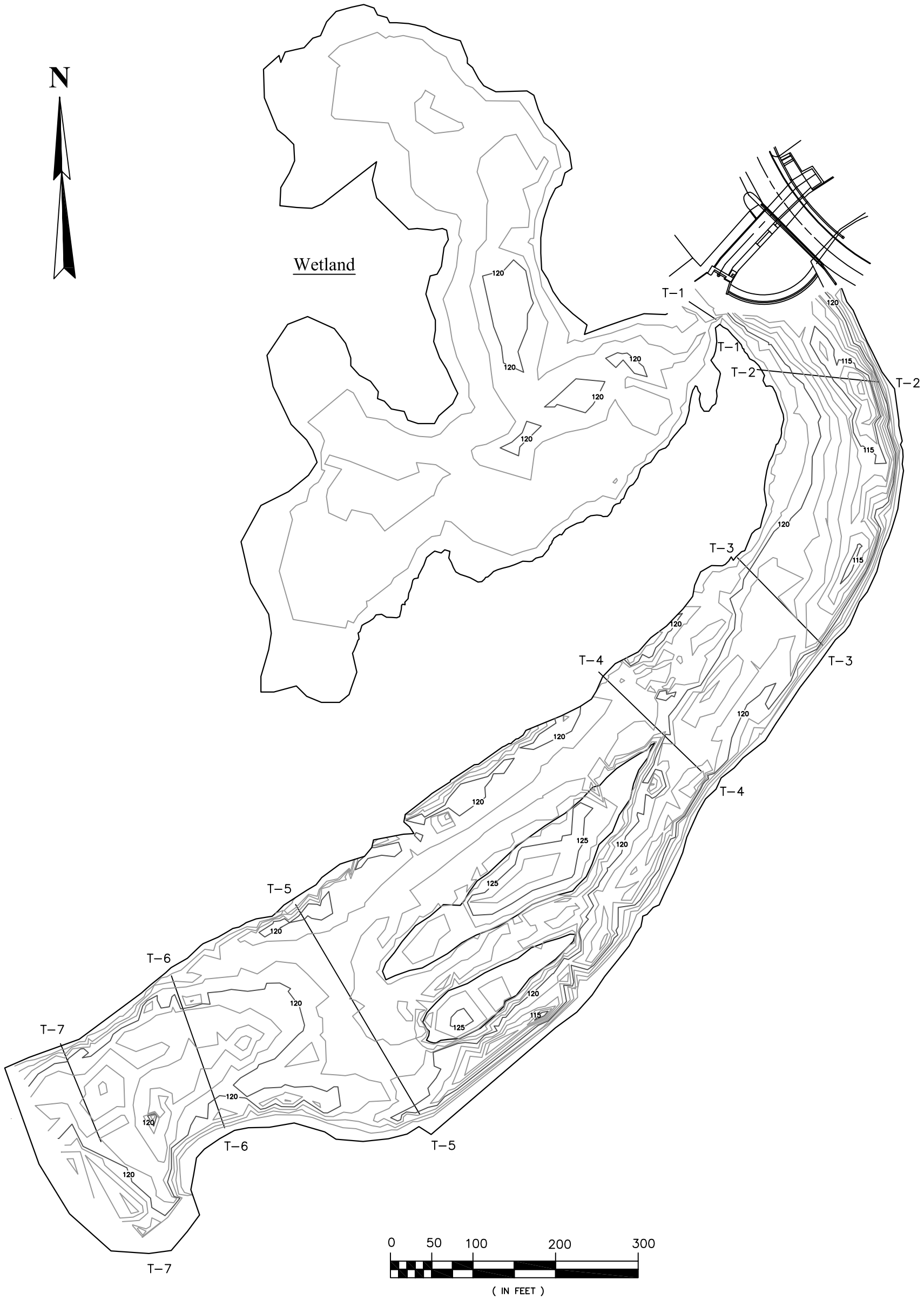
Scale: 1" = 12.5'



NOTES

1. Wetted Perimeter walked with GPS on June 29, 2004 by Gomez and Sullivan.
2. Sediment Depth Transects and Spot-Depth Measurements taken on June 30, 2004 by Gomez and Sullivan.
3. Vertical Datum is NGVD 1929. Reference NH DPW&H benchmark disk Q91934, Elevation 133.446 feet. Located on the northeast parapet wall of the Route 3 bridge over the Souhegan River.
4. Dam detail made from drawings made by Halliwell Associates in 1984 for a FERC licensing application for the Merrimack Village Dam. FERC Drawing No. 8714-1.
5. Contour lines are spaced at intervals of 1 foot. 5-foot contours (115 ft, 120 ft, 125 ft) are labeled and bold.

LEGEND

- Contour Line
- Transect Line
- Boundary Line

FIGURE 4.3-1

Merrimack Village Dam Existing Conditions Map

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: July 2004	
	Scale: 1" = 175'

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
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55 North Stark Highway, Weare, NH 03281, (603) 529-4400

Transect T-1 (outlet of wetland), 43 feet upstream of Merrimack Village Dam, Water and Sediment Depth to Bedrock, Downstream View (WSE = 122.82 feet @ 70 cfs)

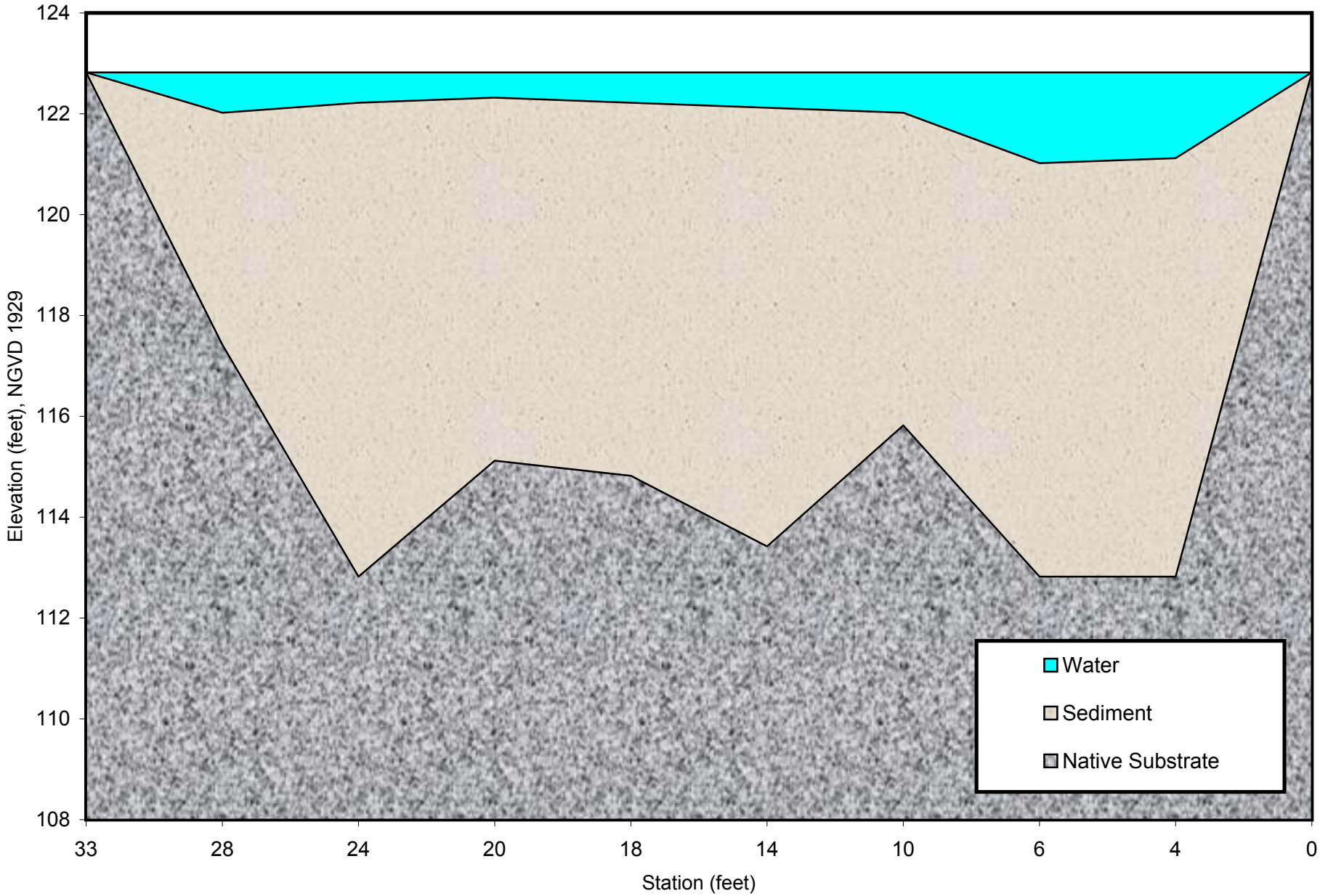


FIGURE 5.1-1

Transect T-2, 104.5 feet upstream of Merrimack Village Dam, Water and Sediment Depth to Bedrock
Downstream View (WSE = 122.82 feet @ 70 cfs)

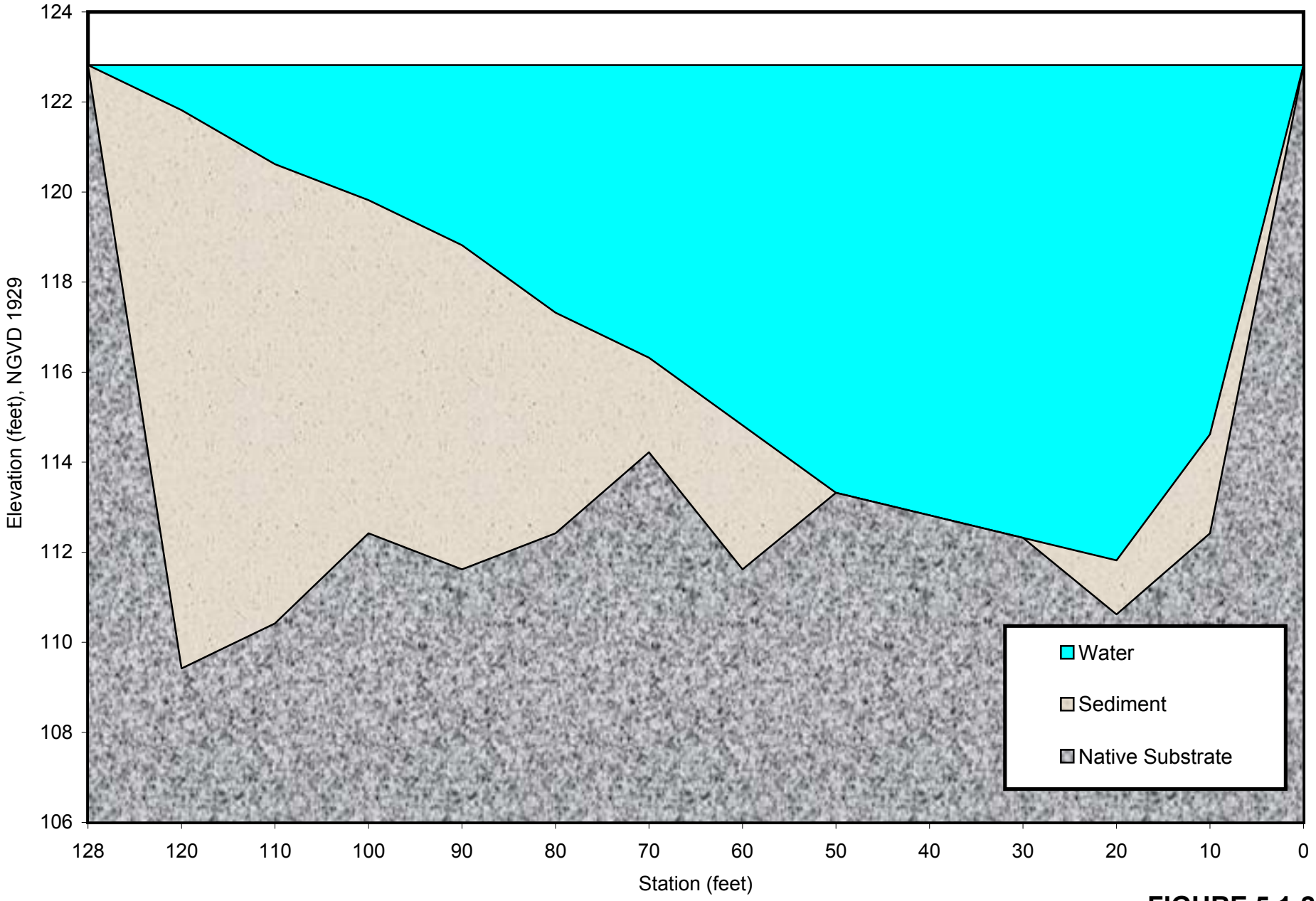


FIGURE 5.1-2

Transect T-3, 408.5 feet upstream of Merrimack Village Dam, Water and Sediment Depth to Bedrock
Downstream View (WSE = 122.82 feet @ 70 cfs)

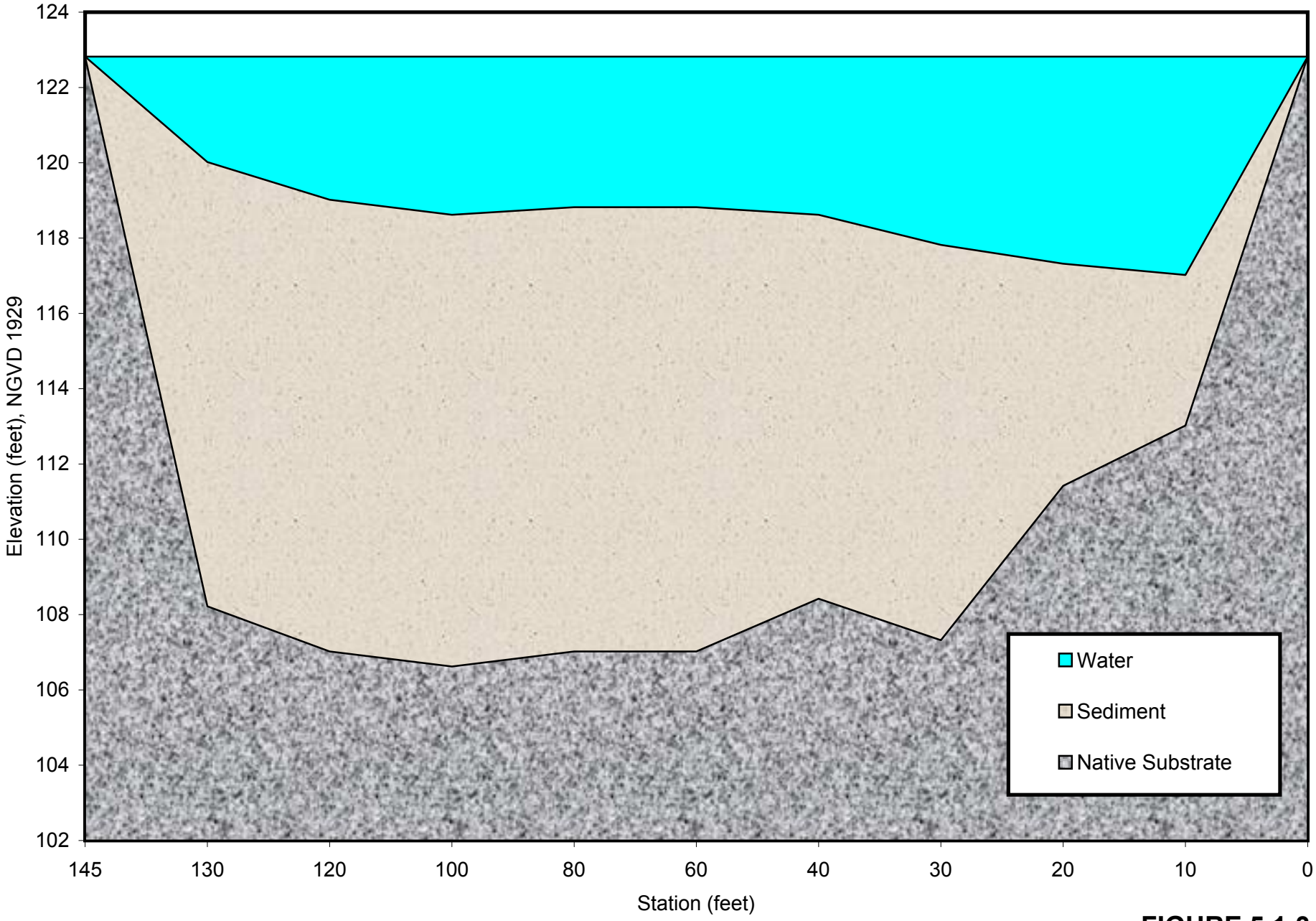


FIGURE 5.1-3

Transect T-4, 623.2 feet upstream of Merrimack Village Dam, Water and Sediment Depth to Bedrock
Downstream View (WSE = 122.82 feet @ 70 cfs)

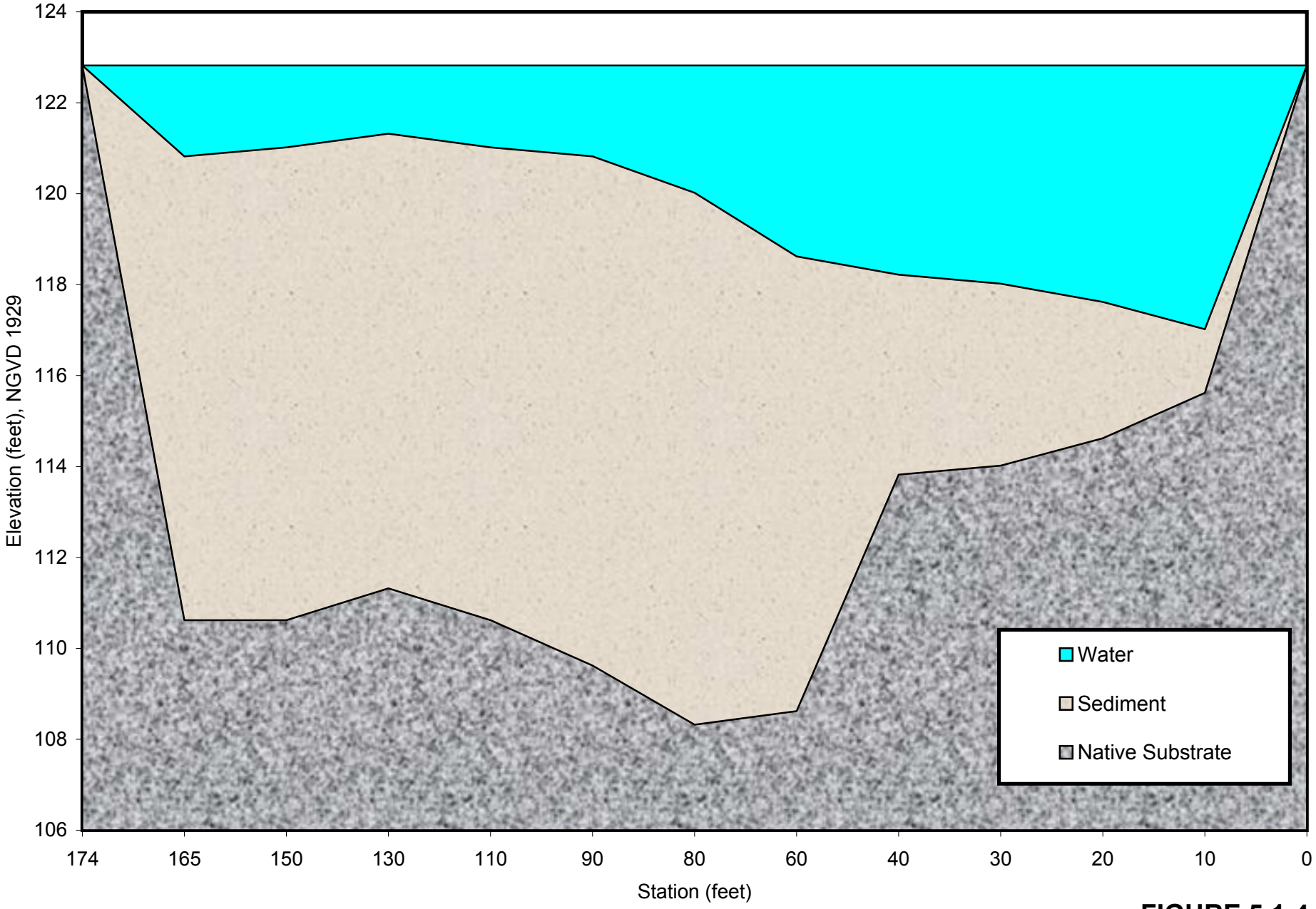


FIGURE 5.1-4

Transect T-5, 1141.9 feet upstream of Merrimack Village Dam, Water and Sediment Depth to Bedrock
Downstream View (WSE = 122.82 feet @ 70 cfs)

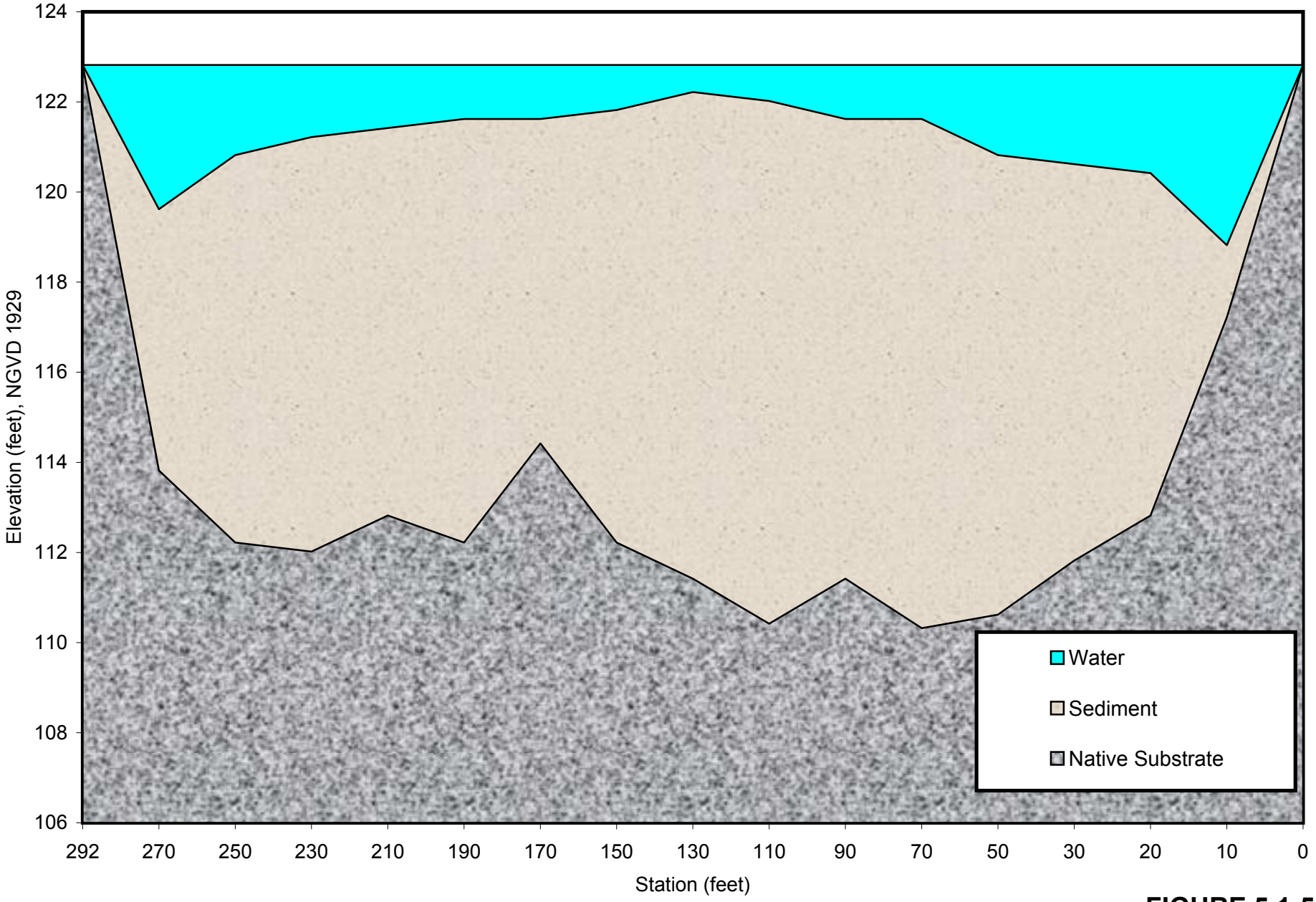


FIGURE 5.1-5

Transect T-6, 1347.1 feet upstream of Merrimack Village Dam, Water and Sediment Depth to Bedrock
Downstream View (WSE = 122.82 feet @ 70 cfs)

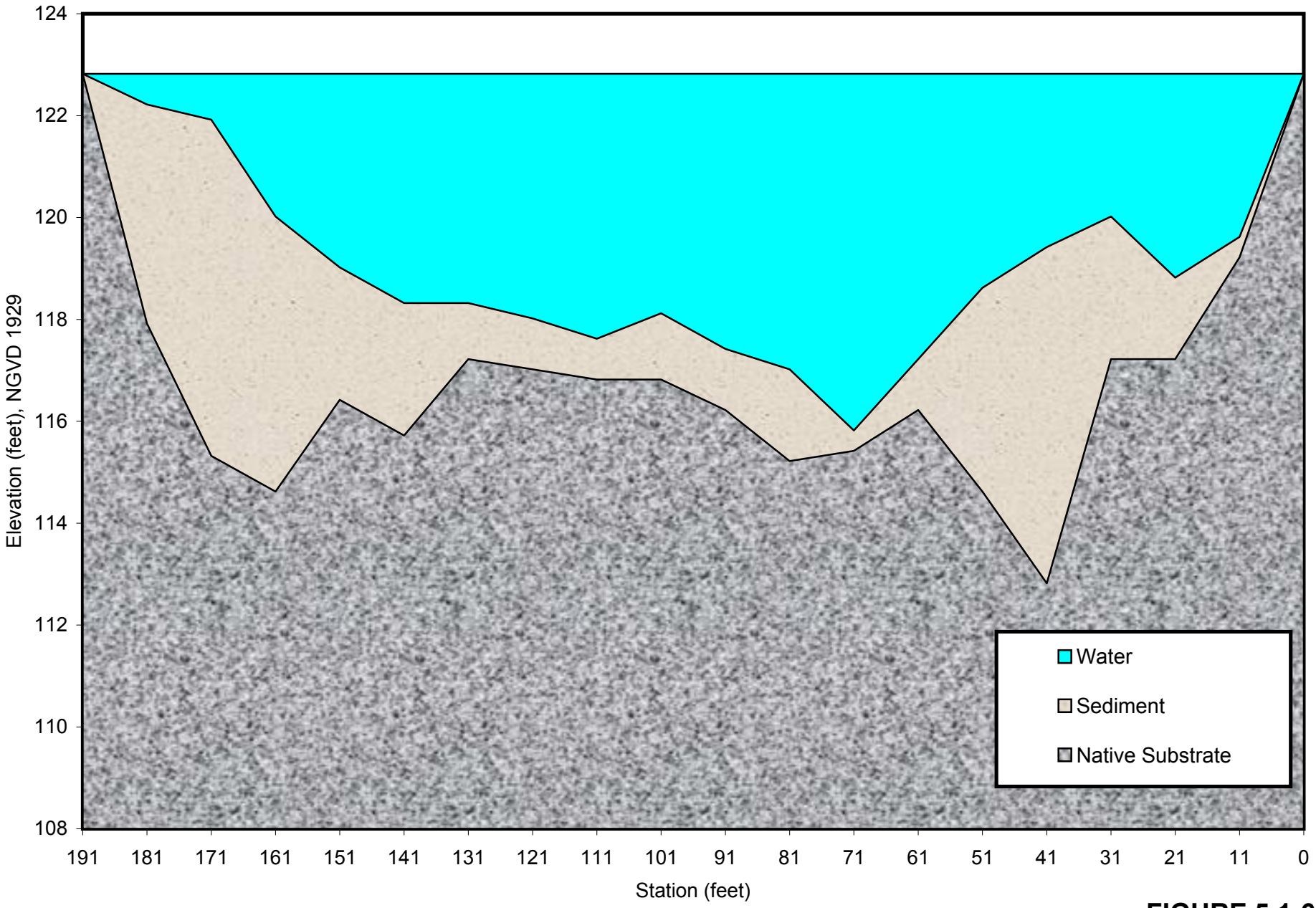


FIGURE 5.1-6

Transect T-7, 1505.7 feet upstream of Merrimack Village Dam, Water and Sediment Depth to Bedrock
Downstream View (WSE = 122.82 feet @ 70 cfs)

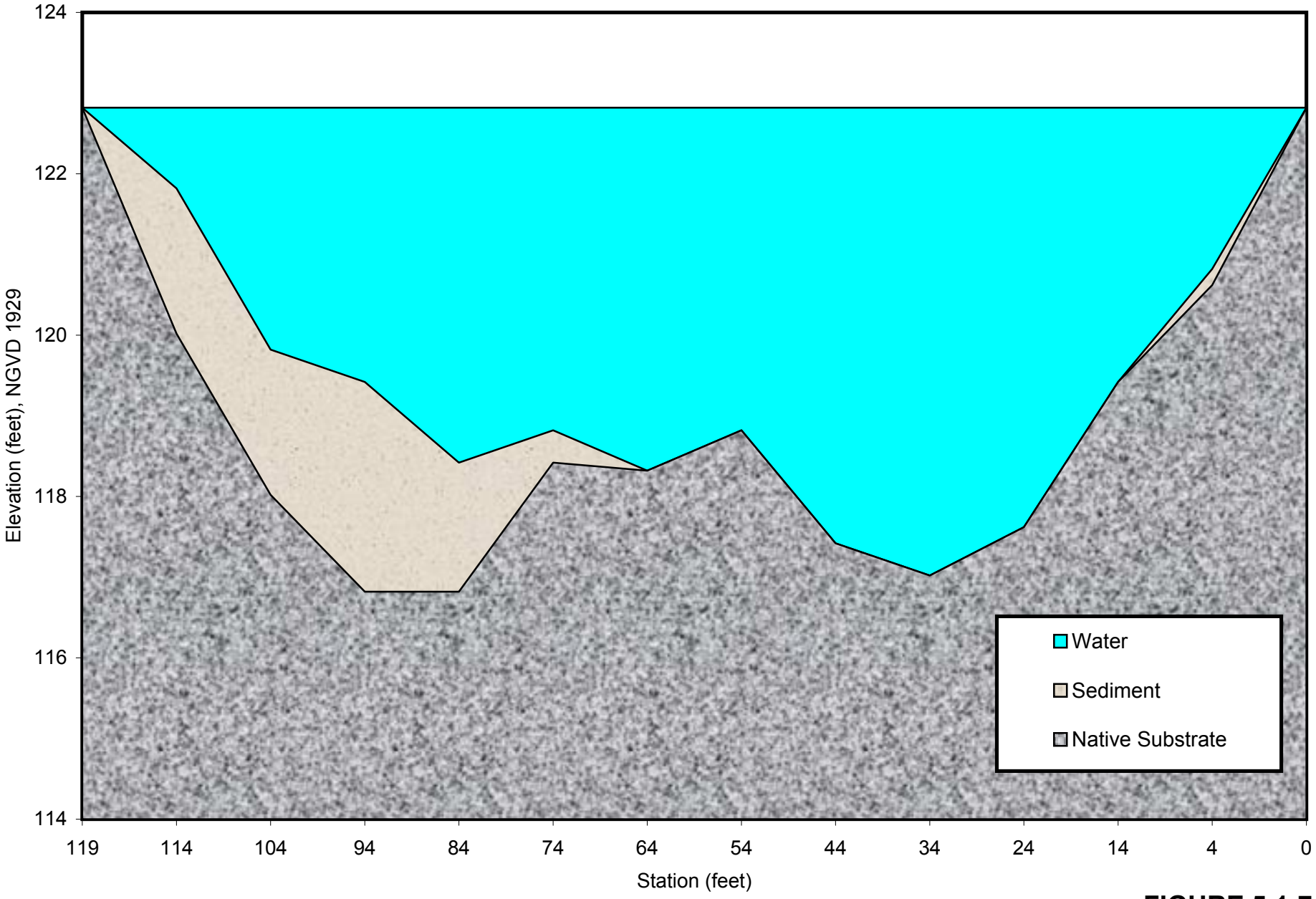
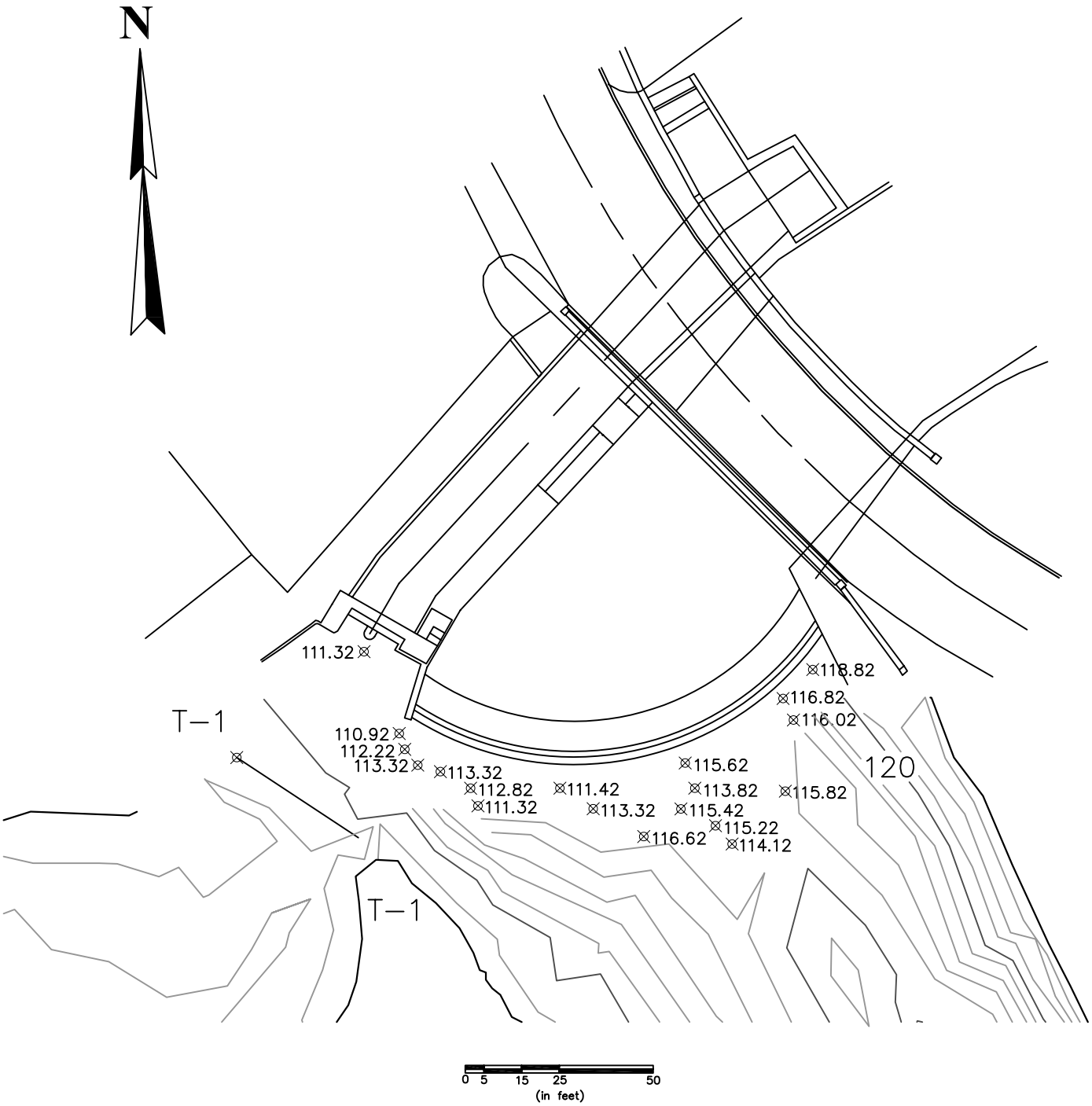


FIGURE 5.1-7



NOTES

1. Contour lines are spaced at 1 foot intervals. Major contour lines are spaced at 5 feet intervals (115, 120, 125, etc.) and are bold.
2. The bathymetric survey was conducted by Gomez and Sullivan Engineers, P.C. on May 13, 14, and 17 of 2004.
3. Dam detail developed from drawings made by Halliwell Associates in 1984 for a FERC licensing application for the Merrimack Village Dam. FERC Drawing No. 8714-1.
4. Sediment spot depth measurements conducted by Gomez and Sullivan Engineers, P.C. on June 30, 2004.
5. Water surface elevation of 122.82 feet. Elevations listed are to depth of refusal of hammered steel rod.

LEGEND

- ⊠ Sediment Spot-Depth Measurement Marker
- Contour Line
- Transect Line
- Boundary Line

FIGURE 5.1-8

Merrimack Village Dam Sediment Spot-Depth Location Map

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: July 2004	

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
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55 North Stark Highway, Weare, NH 03281, (603) 529-4400

Scale: 1" = 40'

Composite Transect immediately upstream of the Merrimack Village Dam, Water and Sediment Depth to Bedrock,
Downstream View (WSE = 122.82 feet @ 70 cfs)

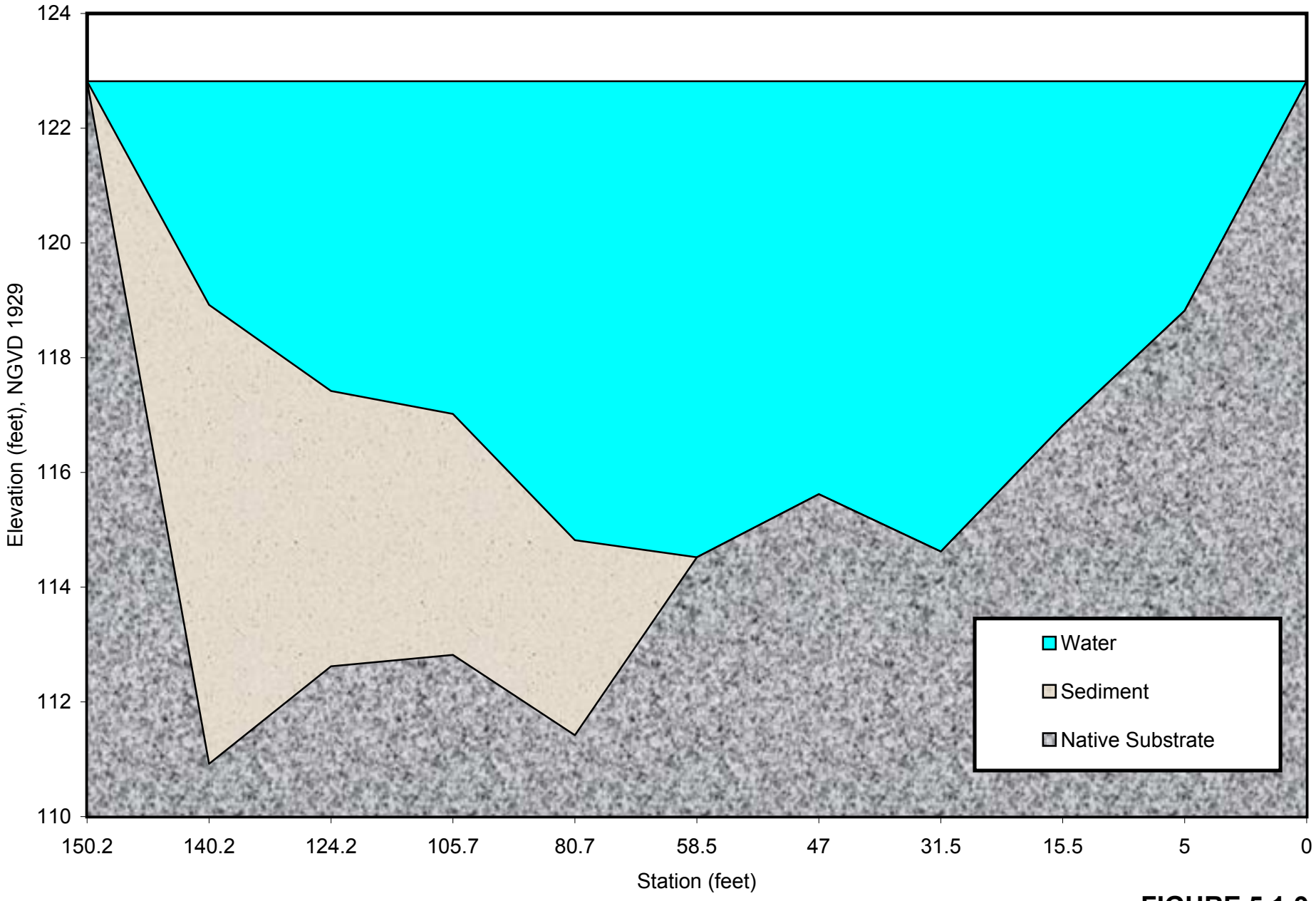


FIGURE 5.1-9

Figure 5.3.1-1 : Sediment Sample Locations

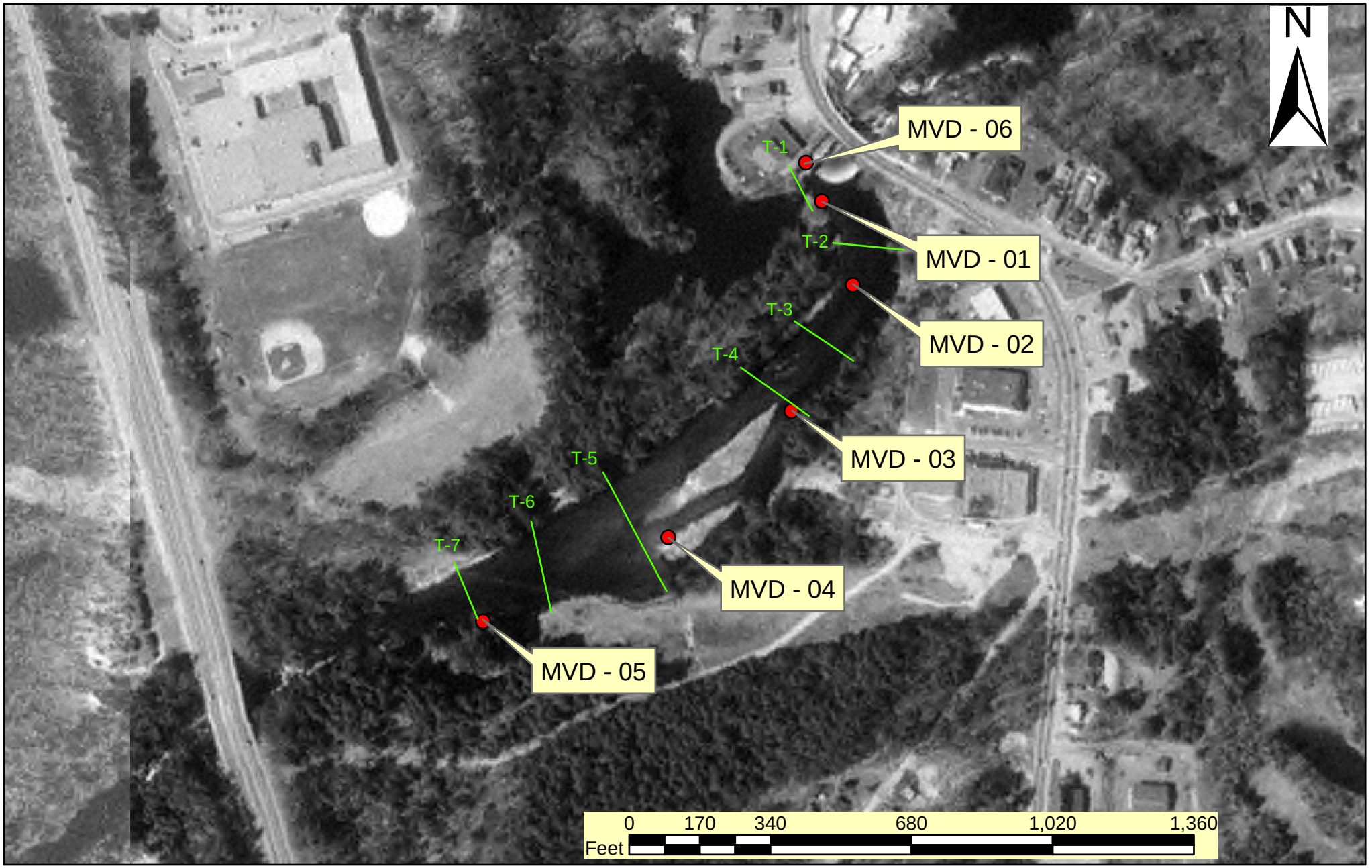
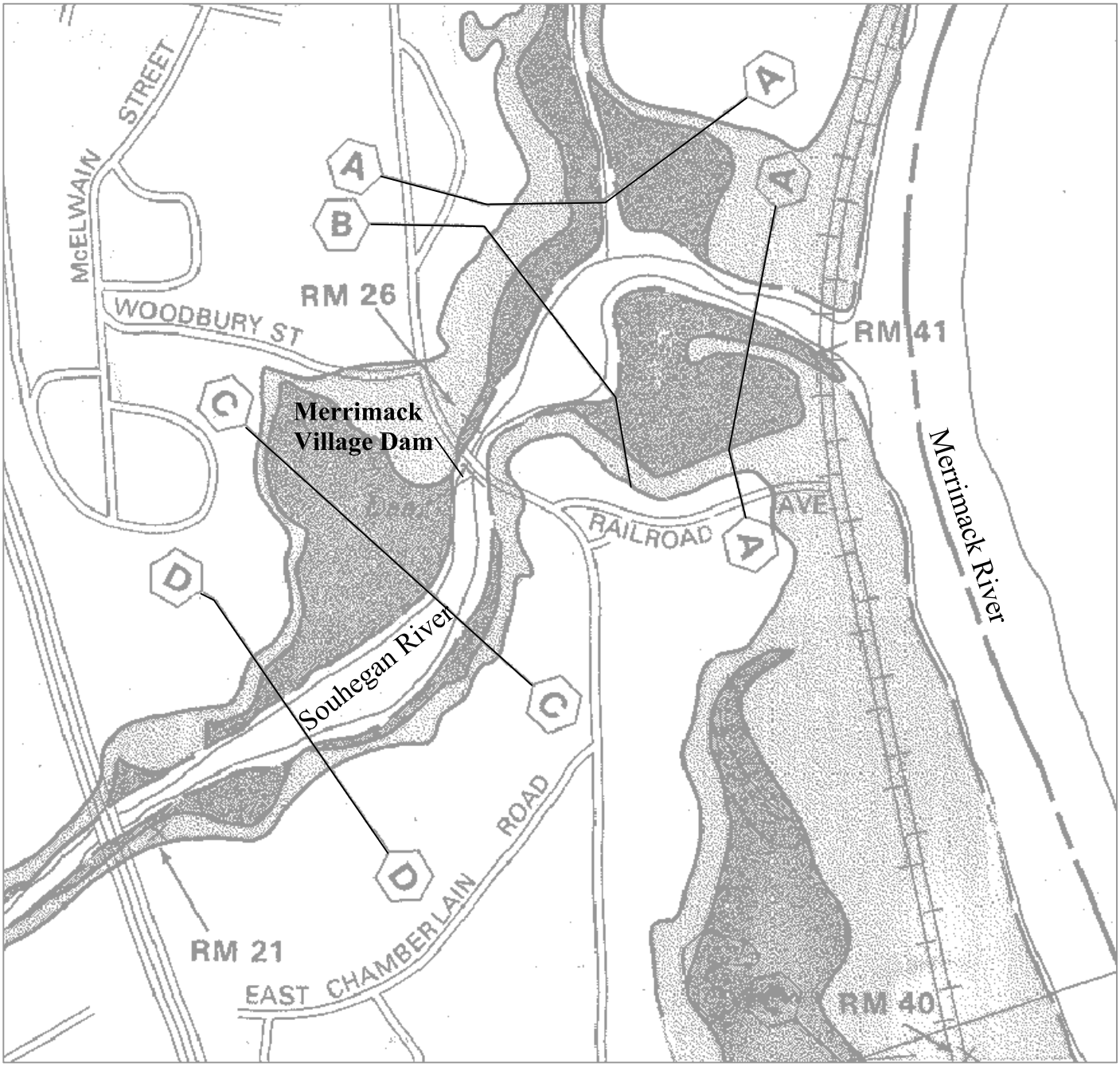


Table 5.3.1-1: U.S. Fish and Wildlife Service Sediment Sampling Results for Merrimack Village Dam

Compound	Screening criteria				Site ID				
	SQuiRT TEL	ORNL TEC	Consensus-based TEC	Consensus-based PEC	MVD01	MVD02	MVD03	MVD04	MVD05
Inorganics (metals)	**(mg/kg)**				**Results (mg/kg)**				
Arsenic	5.90	12.1	9.79	33.0	2.90	2.30	4.20	2.40	6.40
Barium	NG	NG	NG	NG	23.0	20.0	31.0	16.0	56.5
Cadmium	0.596	0.592	0.99	4.98	BDL	BDL	BDL	BDL	0.300
Chromium	37.30	56.00	43.4	111.0	6.00	5.10	8.30	4.30	14.0
Copper	35.70	28.00	31.6	149.0	3.10	2.00	4.50	2.00	6.80
Lead	35.0	34.2	35.8	128.0	7.00	7.00	10.0	< 5.00	10.0
Mercury	0.174	NG	0.18	1.06	BDL	BDL	BDL	BDL	BDL
Nickel	18.00	39.6	22.7	48.6	BDL	BDL	5.00	BDL	7.00
Zinc	123.1	159.0	121	459	30.0	23.0	35.0	19.0	60.0
Organics	**(ug/kg)**				**Results (ug/kg)**				
PAHs									
Anthracene	10.0	31.62	57.2	845	7.70	5.40	20.3	1.20	36.9
Benz(a)anthracene	31.7	260	108	1050	29.9	27.8	60.5	4.20	**156.0**
Benzo(a)pyrene	31.9	350	150	1450	41.5	34.8	81.5	5.10	**211.0**
Benzo(k)fluoranthene	27.2	NG	27.2	NG	21.5	18.7	**38.2**	2.80	**107.0**
Benzo(g,h,i)perylene	NG	290	NG	NG	32.2	27.3	59.2	3.50	156.0
Chrysene	57.1	500	166	1290	48.5	45.0	91.3	5.90	**296.0**
Dibenzo(a,h)anthracene	10.0	NG	33.0	NG	23.1	8.90	18.4	0.70	**56.7**
Fluoranthene	111.0	64.23	423	2230	79.3	61.7	140.0	11.0	332.0
Fluorene	10.0	34.64	77.2	536	2.40	1.90	6.10	0.30	11.8
Indeno(1,2,3-cd)pyrene	17.32	78.0	17.32	NG	**38.0**	**32.5**	**68.1**	3.80	**189.0**
Naphthalene	14.65	32.75	176	561	2.10	1.70	5.60	0.500	9.20
Phenanthrene	41.9	NG	204	1170	37.6	29.4	72.6	5.90	175.0
Pyrene	53.0	570	195	1520	64.6	52.6	114.0	9.10	**276.0**
Pesticides									
Chlordane	4.5	NG	3.24	17.6	BDL	0.0550	0.153	BDL	BDL
Chlorpyrifos	NG	NG	NG	NG	0.244	BDL	0.227	BDL	0.305
Dieldrin	2.8	NG	1.90	61.8	BDL	BDL	0.126	BDL	0.207
p,p'-DDD	3.54	NG	4.88	28.0	0.166	0.132	0.378	BDL	0.588
p,p'-DDE	1.42	NG	3.16	31.3	0.644	0.264	1.47	BDL	2.17
p,p'-DDT	NG	NG	4.16	62.9	0.089	0.099	0.275	BDL	0.621

Notes: **Bold** indicates results exceed consensus-based TEC.
NG=No Guideline
BDL=Below Detection Limit
TEL=Threshold Effects Level (NOAA 1999); TEC=Threshold Effect Concentration (Oak Ridge National Laboratory 1997); PEC=Probable Effect Concentration (McDonald, et al. 2000)



NOTES

1. RM 26 -- Elevation 133.45 feet, NGVD 1929. In Merrimack - A standard NGS&SS disk set in the top of the northeast parapet wall of Route 3 bridge over the Souhegan River.

2. Taken from FEMA Floodway Boundary and Floodway Map for the Town of Merrimack, NH, Hillsborough County. Community Panel Map 33095 0005. Date July 16, 1979.

3. Cross-sections used in the FEMA HEC-2 Model.

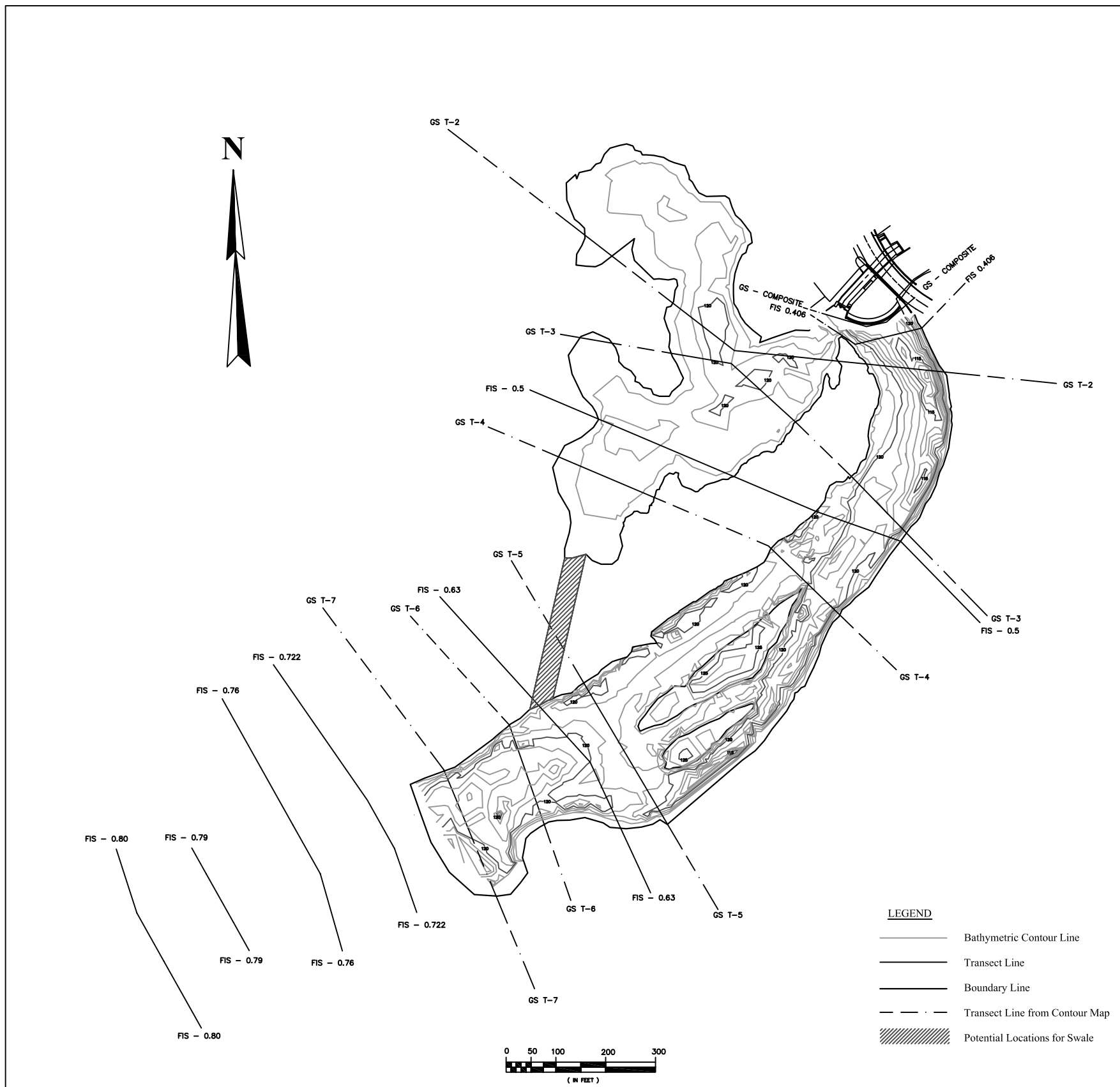
FIGURE 6.3-1

Merrimack Village Dam FEMA FIS Map

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: July 2004	
	Scale: NS

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
288 Genesee Street, Utica, NY 13501, (315) 724-4860
55 North Stark Highway, Weare, NH 03281, (603) 529-4400



Aerial Photograph of impoundment below Everett Turnpike, courtesy of GRANIT.

0 100 200 300 400 500
(IN FEET)

NOTES

1. Wetted Perimeter walked with GPS on June 29, 2004 by Gomez and Sullivan. Sediment Depth Transects and Spot-Depth Measurements taken on June 29 and 30, 2004 by Gomez and Sullivan.
2. Vertical Datum is NGVD 1929. Reference NH DPW&H benchmark disk Q91934, Elevation 133.446 feet. Located on the northeast parapet wall of the Route 3 bridge over the Souhegan River.
3. Dam detail made from drawings made by Halliwell Associates for a 1984 FERC licensing application for the Merrimack Village Dam. FERC Drawing No. 8714-1.
4. Bathymetric contour lines are spaced at intervals of 1 foot. 5-foot contours (115 ft, 120 ft, 125 ft) are labeled and bold.
5. All transects are included in the HEC-RAS model of the Souhegan River, initially developed by FEMA as a HEC-2 model for the 1979 FIS, supplemented by GS.
6. Upland areas were developed from a 5 foot contour map of the town of Merrimack, NH. Areas that were developed from a contour map are shown as dashed lines.
7. FEMA cross-sections are shown as solid lines, however, it is suspected that many of the HEC-2 cross-sections were developed from contour maps rather than field measurement.

FIGURE 6.4.1-1

Merrimack Village Dam HEC-RAS Cross-Sections

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE
CHECKED BY: MARK WAMSER
PROJECT NO. 1210
DATE: July 2004

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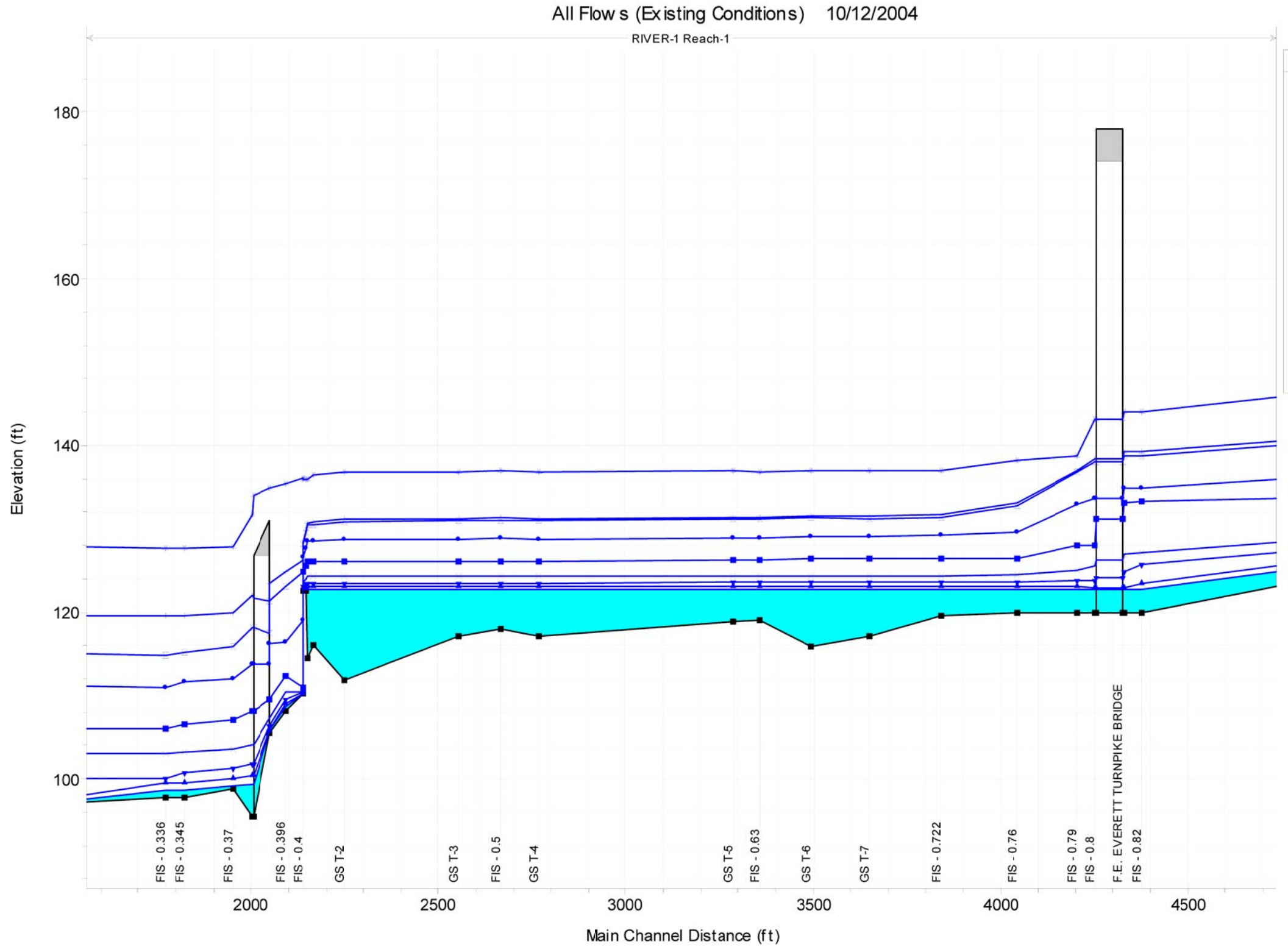
Scale: 1" = 175'

Table 6.4.1-1: Merrimack Village Dam Summary of Hydraulic Conditions - Dam-In Condition

HEC-RAS River X-Section	X-Section Description	7Q10 - 12.8 cfs			August Mean Flow = 78 cfs			Annual Mean Flow = 283 cfs			April Mean Flow = 770 cfs			100-Year Flow = 12,460 cfs		
		Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)
27.00	1000 feet u/s Everett Turnpike	128.41	0.41	2.58	128.84	0.84	3.72	129.38	1.38	5.29	130.21	2.21	7.22	142.50	14.50	5.84
26.00	50 feet u/s Everett Tpk	122.80	2.80	0.20	123.46	3.46	0.89	125.74	5.74	1.52	127.16	7.16	2.80	139.19	19.19	7.48
25.00	Immediately u/s Everett Tpk	122.78	2.78	0.83	122.97	2.97	4.43	124.88	4.88	5.95	126.89	6.89	4.15	139.20	19.20	6.87
24.00	Immediately d/s Everett Tpk	122.76	2.76	0.84	122.96	2.96	4.45	123.75	3.75	10.06	125.47	5.47	9.84	138.37	18.37	7.47
23.00	FEMA 0.79 (~2050 ft u/s)	122.76	2.76	0.20	123.07	3.07	1.04	123.76	3.76	2.68	124.99	4.99	4.48	137.04	17.04	8.72
22.00	FEMA 0.76 (~1900 ft u/s)	122.76	2.76	0.16	123.03	3.03	0.87	123.57	3.57	2.48	124.44	4.44	4.83	133.08	13.08	10.92
21.00	FEMA 0.722 (1700 ft u/s)	122.76	3.26	0.05	123.03	3.53	0.26	123.54	4.04	0.78	124.38	4.88	1.64	131.62	12.12	6.64
20.60	GS Transect T-7 (~1500 ft u/s)	122.76	5.74	0.03	123.03	6.01	0.15	123.54	6.52	0.46	124.36	7.34	1.00	131.48	14.46	3.92
20.30	GS Transect T-6 (~1350 ft u/s)	122.76	6.94	0.02	123.03	7.21	0.10	123.54	7.72	0.32	124.36	8.54	0.74	131.51	15.69	4.18
20.00	FEMA 0.63 (~1200 ft u/s)	122.76	3.76	0.04	123.03	4.03	0.19	123.53	4.53	0.56	124.34	5.34	1.13	131.33	12.33	4.38
19.60	GS Transect T-5 (~1100 ft u/s)	122.76	3.94	0.03	123.03	4.21	0.15	123.53	4.71	0.43	124.33	5.51	0.85	131.40	12.58	2.80
19.30	GS Transect T-4 (~600 ft u/s)	122.76	5.74	0.03	123.03	6.01	0.14	123.51	6.49	0.45	124.28	7.26	1.00	131.24	14.22	1.92
19.00	FEMA 0.5 (~500 ft u/s)	122.76	4.76	0.03	123.03	5.03	0.14	123.51	5.51	0.44	124.27	6.27	0.97	131.29	13.29	1.21
18.60	GS Transect T-3 (~400 ft u/s)	122.76	5.74	0.02	123.03	6.01	0.13	123.51	6.49	0.43	124.27	7.25	0.99	131.16	14.14	1.72
18.30	GS Transect T-2 (~100 ft u/s)	122.76	10.94	0.02	123.03	11.21	0.10	123.51	11.69	0.32	124.26	12.44	0.77	131.13	19.31	1.33
18.00	Wetland Outlet (20 ft u/s)	122.76	6.76	0.02	123.03	7.03	0.11	123.51	7.51	0.34	124.25	8.25	0.71	130.74	14.74	3.32
17.90	GS-Composite (4 ft u/s)	122.76	8.24	0.01	123.03	8.51	0.08	123.51	8.99	0.27	124.25	9.73	0.66	130.62	16.10	5.27
17.00	Merrimack Village Dam	122.75	0.15	0.63	122.99	0.39	1.47	123.39	0.79	2.44	124.00	1.40	3.41	129.70	7.10	6.46
16.00	Merrimack Village Dam	122.66	0.06	1.57	122.82	0.22	2.63	123.12	0.52	3.91	123.60	1.00	5.07	128.30	5.70	8.83
15.00	Top of Apron (50 ft d/s)	110.23	0.03	23.43	110.27	0.07	23.90	110.34	0.14	24.37	110.49	0.29	24.94	126.28	16.08	3.64
14.00	Bottom of Apron (90 ft d/s)	108.58	0.38	2.46	108.97	0.77	3.77	109.55	1.35	5.35	110.38	2.18	7.09	124.88	16.68	8.08
13.00	Immediately u/s Chamberlain Bridge	105.79	0.34	1.58	105.91	0.46	6.16	106.36	0.91	9.27	107.23	1.79	11.30	123.43	17.98	12.18
12.00	Immediately d/s Chamberlain Bridge	99.39	3.84	0.44	100.32	4.77	1.80	101.82	6.27	3.41	104.08	8.52	4.27	122.01	26.45	5.26
11.00	(200 ft d/s MVD)	99.22	0.42	2.71	100.02	1.22	3.29	101.34	2.54	4.55	103.61	4.81	5.14	119.84	21.04	8.52



NOTES

1. Profile derived from HEC-RAS (Hydraulic Engineering Center - River Analysis System, version 3.1.1) for the Souhegan River. This model was developed from the Federal Emergency Management Agency (FEMA) HEC-2 model for the Town of Merrimack, NH Flood Insurance Study (FIS).

2. The original FEMA model has been updated with several additional transects taken by Gomez and Sullivan to improve the accuracy of the model.

FIGURE 6.4.1-2

Water Surface Profile for Dam-In Condition

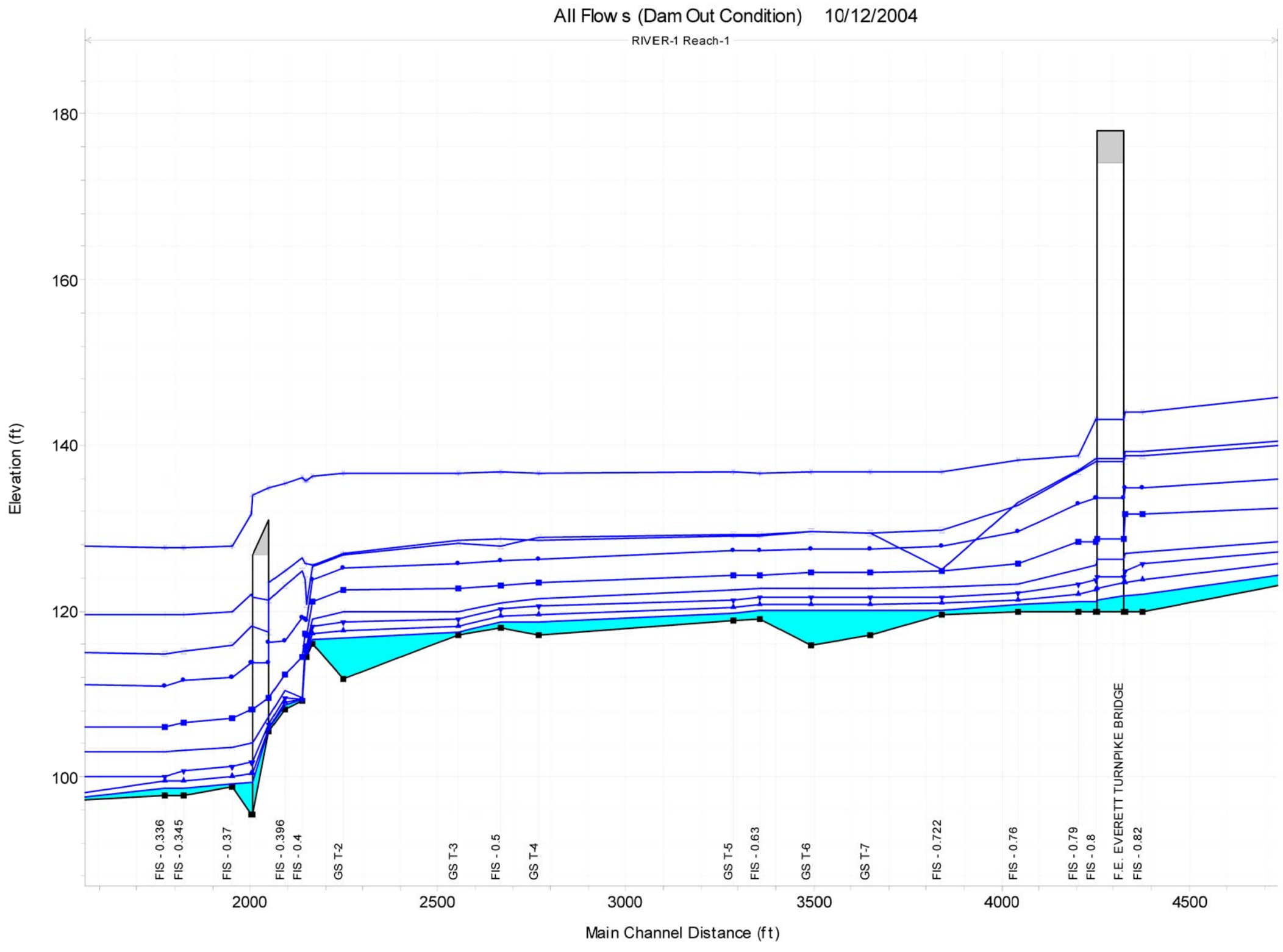
Merrimack Village Dam - Dam Removal Feasibility Study

Drawn by: Braeden MacGuire	
Checked by: Mark Wamser	
Project # 1210	
Date: October 2004	

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
288 Genesee St. Utica, NY 13502 315-724-4860
55 N. Stark Hwy. Weare, NH 03281 603-529-4400

Table 6.4.2-1: Merrimack Village Dam Summary of Hydraulic Conditions - Dam-Out Condition

HEC-RAS River X-Section	X-Section Description	7Q10 - 12.8 cfs			August Mean Flow = 78 cfs			Annual Mean Flow = 283 cfs			April Mean Flow = 770 cfs			100-Year Flow = 12,460 cfs		
		Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)
27.00	1000 feet u/s Everett Turnpike	128.41	0.41	2.58	128.84	0.84	3.72	129.38	1.38	5.29	130.21	2.21	7.22	142.50	14.50	5.84
26.00	50 feet u/s Everett Tpk	121.96	1.96	0.31	123.73	3.73	0.80	125.74	5.74	1.52	127.16	7.16	2.80	139.18	19.18	7.49
25.00	Immediately u/s Everett Tpk	121.87	1.87	1.83	123.47	3.47	3.24	124.88	4.88	5.95	126.89	6.89	4.15	139.19	19.19	6.88
24.00	Immediately d/s Everett Tpk	121.20	1.20	4.46	122.47	2.47	6.40	123.75	3.75	10.06	125.46	5.46	9.87	138.35	18.35	7.49
23.00	FEMA 0.79 (~2050 ft u/s)	121.12	1.12	0.99	122.00	2.00	2.15	123.25	3.25	3.43	124.97	4.97	4.52	137.01	17.01	8.74
22.00	FEMA 0.76 (~1900 ft u/s)	120.83	0.83	1.24	121.37	1.37	2.95	122.19	2.19	5.11	123.30	3.30	7.58	133.11	13.11	10.87
21.00	FEMA 0.722 (1700 ft u/s)	120.03	0.53	1.37	120.89	1.39	1.21	121.74	2.24	1.86	122.85	3.35	2.78	125.01	5.51	22.19
20.60	GS Transect T-7 (~1500 ft u/s)	120.03	3.01	0.09	120.88	3.86	0.33	121.70	4.68	0.86	122.76	5.74	1.61	129.44	12.42	5.22
20.30	GS Transect T-6 (~1350 ft u/s)	120.03	4.21	0.05	120.88	5.06	0.19	121.70	5.88	0.53	122.75	6.93	1.07	129.50	13.68	5.36
20.00	FEMA 0.63 (~1200 ft u/s)	120.03	1.03	0.48	120.87	1.87	0.90	121.65	2.65	1.61	122.65	3.65	2.32	129.03	10.03	6.26
19.60	GS Transect T-5 (~1100 ft u/s)	119.73	0.91	3.42	120.40	1.58	4.35	121.34	2.52	3.19	122.54	3.72	2.09	129.11	10.29	4.18
19.30	GS Transect T-4 (~600 ft u/s)	118.77	1.75	0.32	119.55	2.53	0.88	120.54	3.52	1.74	121.50	4.48	2.74	128.60	11.58	2.92
19.00	FEMA 0.5 (~500 ft u/s)	118.71	0.71	1.45	119.39	1.39	2.30	120.28	2.28	3.02	120.90	2.90	4.42	128.72	10.72	1.67
18.60	GS Transect T-3 (~400 ft u/s)	117.53	0.51	3.04	118.13	1.11	4.60	119.03	2.01	4.33	119.89	2.87	4.58	128.51	11.49	2.17
18.30	GS Transect T-2 (~100 ft u/s)	116.83	5.01	0.06	117.72	5.90	0.29	118.65	6.83	0.82	119.91	8.09	1.67	126.99	15.17	8.65
18.00	Wetland Outlet (20 ft u/s)	116.65	0.65	3.28	117.34	1.34	4.71	118.12	2.12	5.54	119.02	3.02	7.16	125.46	9.46	8.28
17.90	GS-Composite (4 ft u/s)	114.78	0.26	5.36	115.01	0.49	8.58	115.39	0.87	10.43	115.87	1.35	12.66	125.71	11.19	8.69
17.00	Merrimack Village Dam	114.66	0.14	20.73	115.24	0.72	4.17	115.61	1.09	6.79	116.07	1.55	10.11	125.70	11.18	8.71
15.00	Top of Apron (50 ft d/s)	109.37	0.17	0.80	109.28	0.08	17.26	109.37	0.17	17.94	109.55	0.35	19.87	126.34	17.14	3.41
14.00	Bottom of Apron (90 ft d/s)	108.58	0.38	2.46	108.97	0.77	3.77	109.55	1.35	5.35	110.38	2.18	7.09	124.88	16.68	8.08
13.00	Immediately u/s Chamberlain Bridge	105.79	0.34	1.58	105.91	0.46	6.16	106.36	0.91	9.27	107.23	1.79	11.30	123.43	17.98	12.18
12.00	Immediately d/s Chamberlain Bridge	99.39	3.84	0.44	100.32	4.77	1.80	101.82	6.27	3.41	104.08	8.52	4.27	122.01	26.45	5.26
11.00	(200 ft d/s MVD)	99.22	0.42	2.71	100.02	1.22	3.29	101.34	2.54	4.55	103.61	4.81	5.14	119.84	21.04	8.52



NOTES

1. Profile derived from HEC-RAS (Hydraulic Engineering Center - River Analysis System, version 3.1.1) for the Souhegan River. This model was developed from the Federal Emergency Management Agency (FEMA) HEC-2 model for the Town of Merrimack, NH Flood Insurance Study (FIS).

2. The original FEMA model has been updated with several additional transects taken by Gomez and Sullivan to improve the accuracy of the model.

FIGURE 6.4.2-1

Water Surface Profile for Dam-Out Condition

Merrimack Village Dam - Dam Removal Feasibility Study

Drawn by: Braeden MacGuire	
Checked by: Mark Wamser	
Project # 1210	
Date: October 2004	

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
288 Genesee St. Utica, NY 13502 315-724-4860
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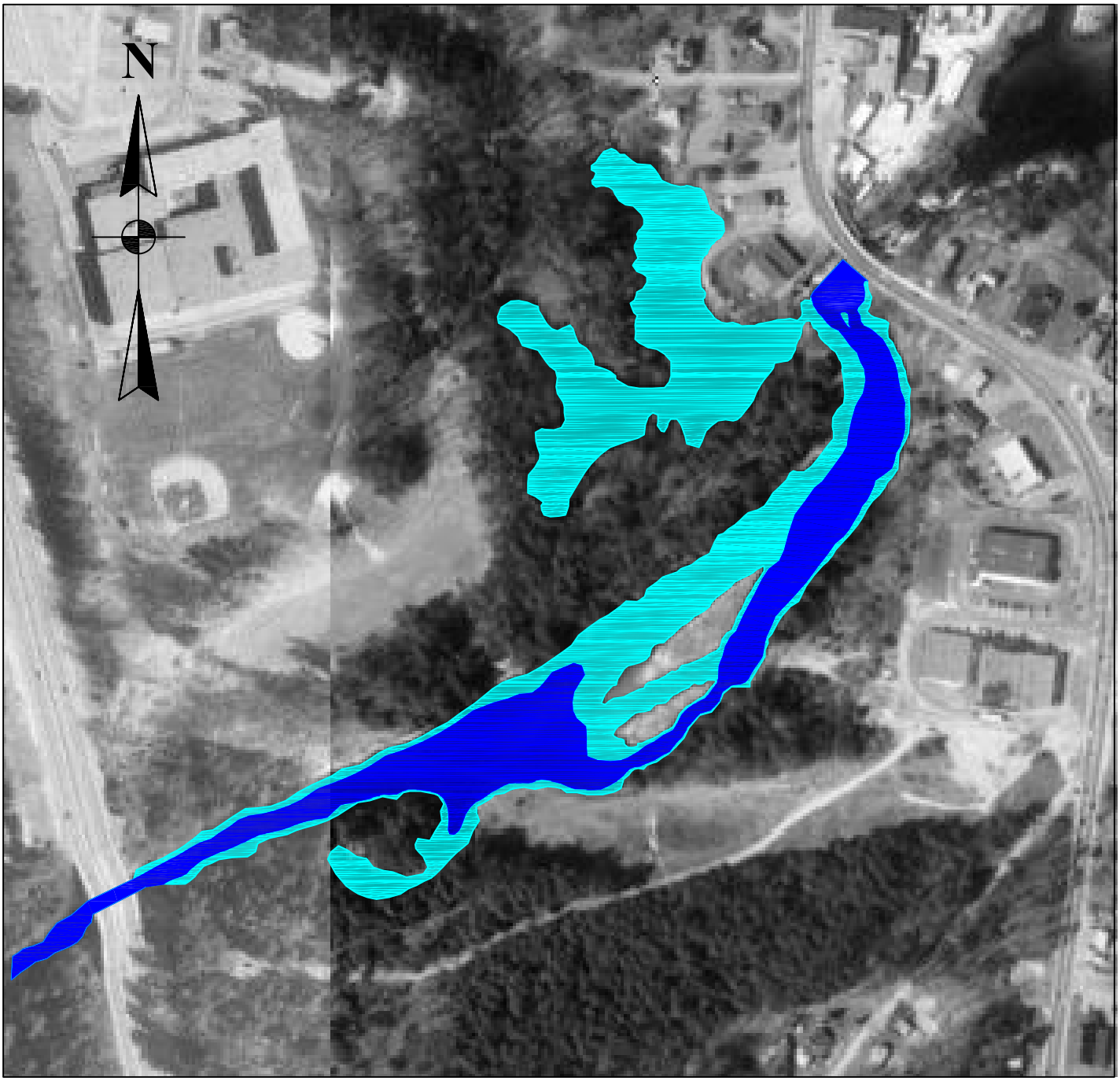


Current Water Surface

Predicted Water Surface Following Dam Removal, Short-term

NOTES

1. Digital Orthophoto Quarter Quadrangle (DOQQ) taken from the GRANIT website.
2. Predicted Short-term Water Surface developed from channel widths resulting from a HEC-RAS run for the Dam-Out scenario and the Annual Mean Flow for the period of record.
3. Current Water Surface depicted was digitized from the evident water surface in the DOQQ.

FIGURE 6.4.2-2

Merrimack Village Dam - Plan View of Current Condition and Predicted Short-term River Response to Dam Removal

Merrimack Village Dam - Dam Removal Feasibility Study

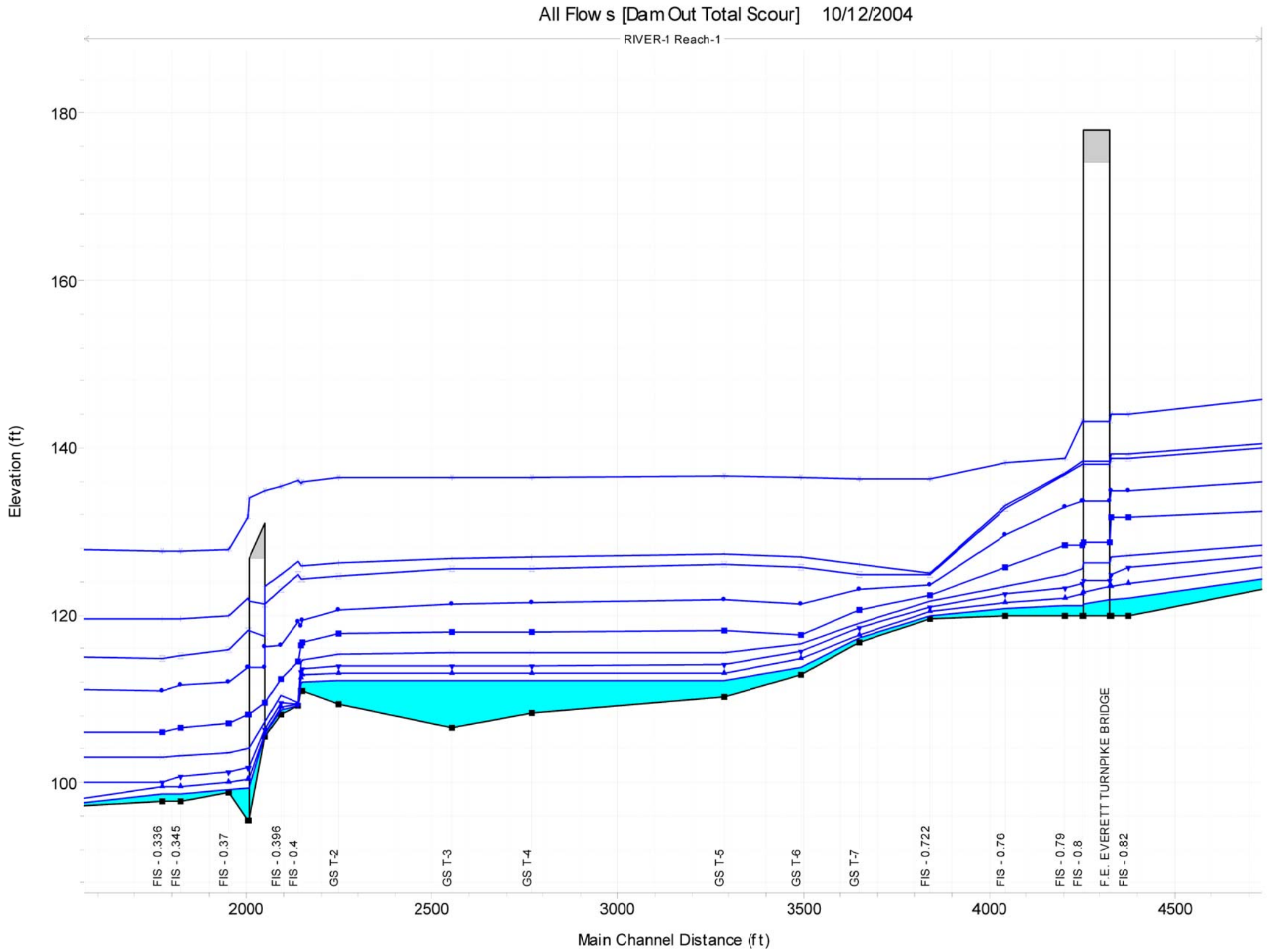
DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: September 2004	

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
288 Genesee Street, Utica, NY 13501, (315) 724-4860
55 North Stark Hwy, Weare, NH 03281, (603) 529-4400

SCALE: 1" = 300'

Table 6.4.3-1: Merrimack Village Dam Summary of Hydraulic Conditions - Dam-Out (Absent Sediment) Condition

HEC-RAS River X-Section	X-Section Description	7Q10 - 12.8 cfs			August Mean Flow = 78 cfs			Annual Mean Flow = 283 cfs			April Mean Flow = 770 cfs			100-Year Flow = 12,460 cfs		
		Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)	Water Surface Elev. (NGVD, feet)	Water Depth to Thalweg (feet)	Mean Water Velocity (ft/sec)
27.00	1000 feet u/s Everett Turnpike	128.41	0.41	2.58	128.84	0.84	3.72	129.38	1.38	5.29	130.21	2.21	7.22	142.50	14.50	5.84
26.00	50 feet u/s Everett Tpk	121.96	1.96	0.31	123.73	3.73	0.80	125.74	5.74	1.52	127.16	7.16	2.80	139.19	19.19	7.48
25.00	Immediately u/s Everett Tpk	121.87	1.87	1.83	123.47	3.47	3.24	124.88	4.88	5.95	126.89	6.89	4.15	139.20	19.20	6.87
24.00	Immediately d/s Everett Tpk	121.20	1.20	4.46	122.47	2.47	6.40	123.75	3.75	10.06	125.46	5.46	9.87	138.37	18.37	7.47
23.00	FEMA 0.79 (~2050 ft u/s)	121.12	1.12	0.98	122.00	2.00	2.14	123.22	3.22	3.48	124.89	4.89	4.63	137.03	17.03	8.72
22.00	FEMA 0.76 (~1900 ft u/s)	120.87	0.87	1.14	121.58	1.58	2.32	122.49	2.48	4.23	123.49	3.49	6.96	133.08	13.08	10.92
21.00	FEMA 0.722 (1700 ft u/s)	119.97	0.47	1.75	120.40	0.90	2.87	120.98	1.48	3.88	121.69	2.19	5.25	125.01	5.51	22.17
20.60	GS Transect T-7 (~1500 ft u/s)	117.21	0.39	2.20	117.71	0.89	3.29	118.44	1.62	4.36	119.12	2.30	6.21	126.05	9.23	9.57
20.30	GS Transect T-6 (~1350 ft u/s)	113.74	0.92	3.90	114.77	1.95	5.17	115.78	2.96	5.24	116.59	3.77	6.18	126.98	14.16	6.01
19.60	GS Transect T-5 (~1100 ft u/s)	112.10	1.78	0.10	113.01	2.69	0.27	114.03	3.71	0.54	115.52	5.20	0.85	127.25	16.93	2.78
19.30	GS Transect T-4 (~600 ft u/s)	112.10	3.78	0.05	113.01	4.69	0.23	114.00	5.68	0.60	115.46	7.14	1.12	126.91	18.59	4.59
18.60	GS Transect T-3 (~400 ft u/s)	112.10	5.48	0.02	113.01	6.39	0.12	114.00	7.38	0.37	115.46	8.84	0.81	126.81	20.19	4.86
18.30	GS Transect T-2 (~100 ft u/s)	112.10	2.67	0.27	113.00	3.58	0.68	113.97	4.55	1.30	115.38	5.96	2.03	126.17	16.75	6.92
17.90	GS-Composite (4 ft u/s)	112.01	1.09	1.96	112.79	1.87	2.93	113.55	2.63	4.44	114.61	3.69	6.38	125.97	15.05	7.25
17.00	Merrimack Village Dam	111.82	0.90	3.32	112.51	1.59	4.57	113.27	2.35	5.66	114.23	3.31	7.73	125.96	15.04	7.26
15.00	Top of Apron (50 ft d/s)	109.24	0.04	10.24	109.30	0.10	12.93	109.39	0.19	15.02	109.59	0.39	17.39	126.34	17.14	3.41
14.00	Bottom of Apron (90 ft d/s)	108.58	0.38	2.46	108.97	0.77	3.77	109.55	1.35	5.35	110.38	2.18	7.09	124.88	16.68	8.08
13.00	Immediately u/s Chamberlain Bridge	105.79	0.34	1.58	105.91	0.46	6.16	106.36	0.91	9.27	107.23	1.79	11.30	123.43	17.98	12.18
12.00	Immediately d/s Chamberlain Bridge	99.39	3.84	0.44	100.32	4.77	1.80	101.82	6.27	3.41	104.08	8.52	4.27	122.01	26.45	5.26
11.00	(200 ft d/s MVD)	99.22	0.42	2.71	100.02	1.22	3.29	101.34	2.54	4.55	103.61	4.81	5.14	119.84	21.04	8.52



NOTES

1. Profile derived from HEC-RAS (Hydraulic Engineering Center - River Analysis System, version 3.1.1) for the Souhegan River. This model was developed from the Federal Emergency Management Agency (FEMA) HEC-2 model for the Town of Merrimack, NH Flood Insurance Study (FIS).

2. The original FEMA model has been updated with several additional transects taken by Gomez and Sullivan to improve the accuracy of the model.

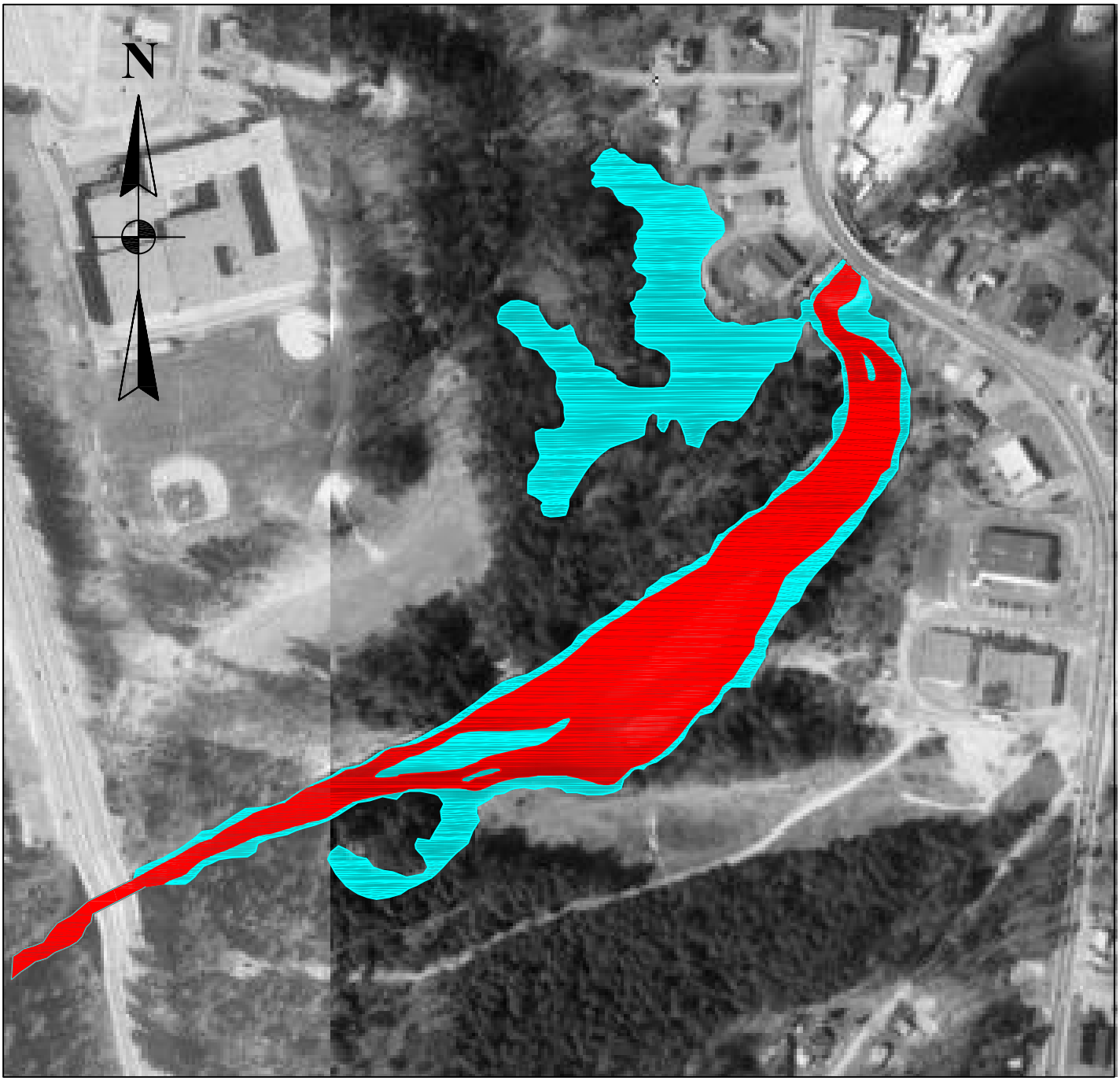
FIGURE 6.4.3-1

Water Surface Profile for Dam-Out Condition (Absent Sediment)

Merrimack Village Dam - Dam Removal Feasibility Study

Drawn by: Braeden MacGuire
Checked by: Mark Wamser
Project # 1210
Date: October 2004

Gomez and Sullivan Engineers, P.C.
Engineers and Environmental Scientists
288 Genesee St. Utica, NY 13502 315-724-4860
55 N. Stark Hwy. Weare, NH 03281 603-529-4400



Current Water Surface

Predicted Water Surface Following Dam Removal, Long-Term (Absent All Sediment)

NOTES

1. Digital Orthophoto Quarter Quadrangle (DOQQ) taken from the GRANIT website.
2. Predicted Long-term Water Surface developed from channel widths resulting from a HEC-RAS run for the Dam-Out (Absent Sediment) scenario and the Annual Mean Flow for the period of record.
3. Current Water Surface depicted was digitized from the evident water surface in the DOQQ.

DRAWN BY: BRAEDEN MacGUIRE
CHECKED BY: MARK WAMSER
PROJECT NO. 1210
DATE: September 2004

FIGURE 6.4.3-2

Merrimack Village Dam - Plan View of Current Condition and Predicted River Response to Dam Removal (Absent Sediment)

Merrimack Village Dam - Dam Removal Feasibility Study

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SCALE: 1" = 300'

LEGEND

- Palustrine Open Water
- Palustrine Forested, Broad-leaved Deciduous
- Upland
- Riverine, Upper Perennial, Open Water

NOTES

1. Wetlands delineation by The Smart Associates, Environmental Consultants, Inc. on August 6, 2004.
2. Aerial photo courtesy of the GRANIT website.
3. Figure developed from drawings provided by The Smart Associates.

FIGURE 9.1-1

Merrimack Village Dam - Wetlands Map

Merrimack Village Dam - Dam Removal Feasibility Study

DRAWN BY: BRAEDEN MacGUIRE	
CHECKED BY: MARK WAMSER	
PROJECT NO. 1210	
DATE: AUGUST 2004	

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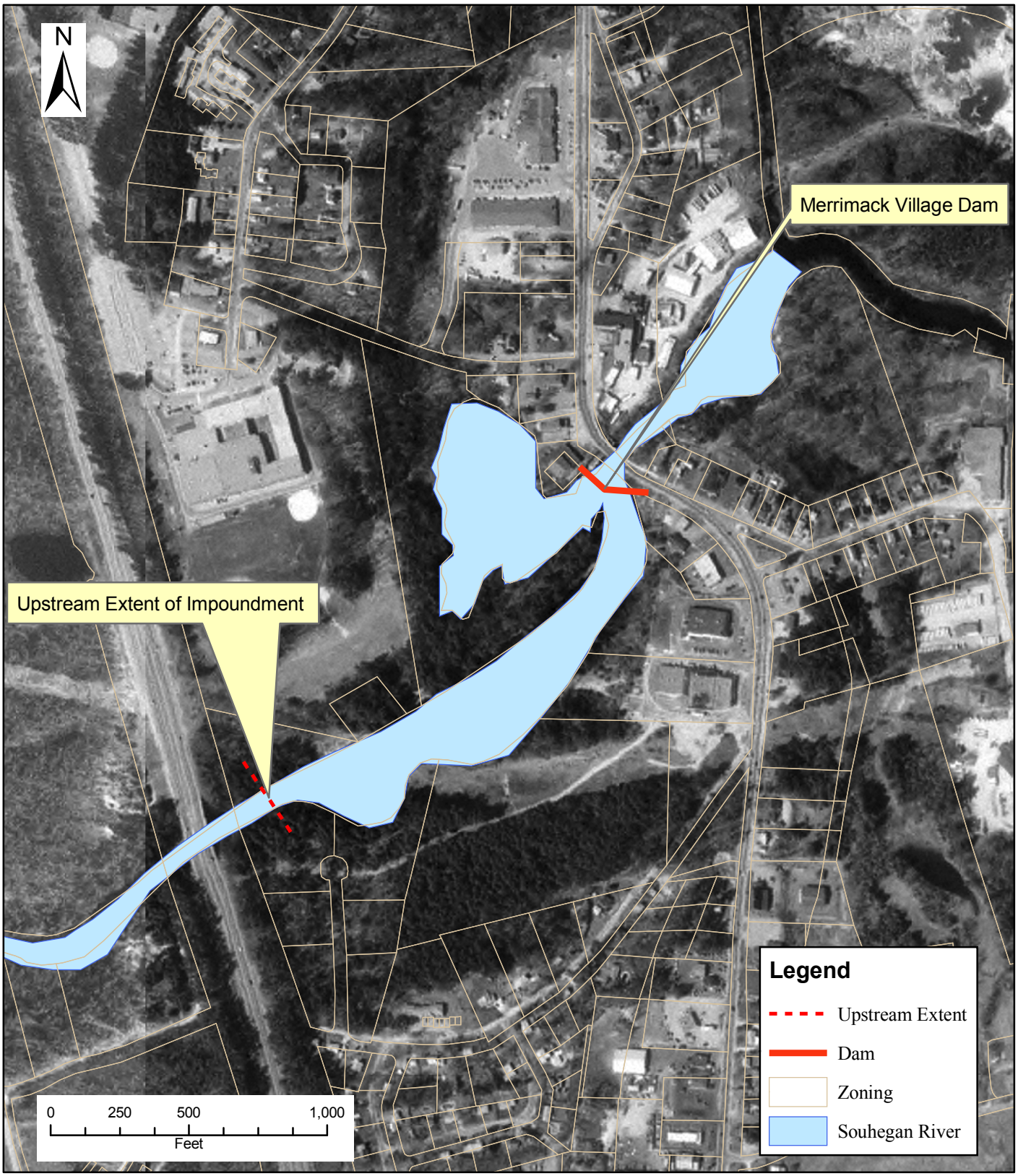
SCALE: N/S

Table 9.3-1: July 2004 NH National Heritage Bureau Rare, Threatened, and Endangered Plants and Animals for the Town of Merrimack, NH

Flag	Species or Community Name	Listed?		# Reported in the Last 20 Yrs	
		Federal	State	Town	State
Plants					
	Bald Spike-rush (Eleocharis erythropoda)	--	-	Historical	4
**	Bird's-foot Violet (Viola pedata var. linearilobа)	--	T	1	12
**	Blunt-leaved Milkweed (Asclepias amplexicaulis)	--	T	1	13
**	Burgrass (Cenchrus longispinus)	--	T	2	10
	Butterfly-weed (Asclepias tuberosa)	--	E	Historical	7
	Goat's-rue (Tephrosia virginiana)	--	E	Historical	6
	Low Bindweed (Convolvulus spithamaeus)	--	T	Historical	7
	Philadelphia Panic-grass (Panicum philadelphicum)	--	E	Historical	8
	Siberian Chives (Allium schoenoprasum var. sibiricum)	--	T	Historical	7
	Skydrop Aster (Aster patens var. patens)	--	T	Historical	10
*	Small Bidens (Bidens discoidea)	--	E	1	9
	Smooth Bidens (Bidens laevis)	--	-	Historical	1
	Stiff Tick-trefoil (Desmodium rigidum)	--	E	Historical	2
	Virginian Mt. Mint (Pycnanthemum virginianum)	--	E	Historical	3
	Wild Garlic (Allium canadense)	--	E	Historical	5
	Wild Lupine (Lupinus perennis)	--	T	Historical	38
	Wild Senna (Cassia hebecarpa)	--	E	Historical	10
Vertebrates - Mammals					
**	New England Cottontail (Sylvilagus Transitionalis)	--	-	2	19
Vertebrates - Birds					
**	Grasshopper Sparrow (Ammodramus savannarum)	--	T	1	10
**	Vesper Sparrow (Pooecetes gramineus)	--	W	2	11
Vertebrates - Reptiles					
**	Blanding's Turtle (Emydoidea blandingii)	--	-	2	79
**	Eastern Box Turtle (Terrapene carolina)	--	-	1	6
**	Eastern Hognose Snake (Heterodon platirhinos)	--	T	1	17
Vertebrates - Fish					
**	American Brook Lamprey (Lampetra appendix)	--	-	1	2
	Banded Sunfish (Enneacanthus obesus)	--	-	Historical	19
**	Bridled Shiner (Notropis bifrenatus)	--	-	1	17
**	Swamp Darter (Etheostoma fusiforme)	--	-	1	9
Invertebrates - Insects					
	Karner Blue Butterfly (Lycaeides melissa samuelis)	E	E	Historical	7
	Persius Dusky Wing (Erynnis persius persius)	--	E	Historical	6

T-Threatened
E-Endangered
W-Watch
*High- A marginal example of a state rarity
**Very High- A marginal example of a global rarity or a good example of a state rarity.

Figure 13.0-1: Property Ownership near Merrimack Village Dam and around the Impoundment



Source Information:
- Zoning information provided courtesy of the Town of Merrimack
- NH GRANIT: "Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of State Planning (OSP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. Neither OSP nor CSRC make any claim as to the validity or reliability or to any implied uses of these data."